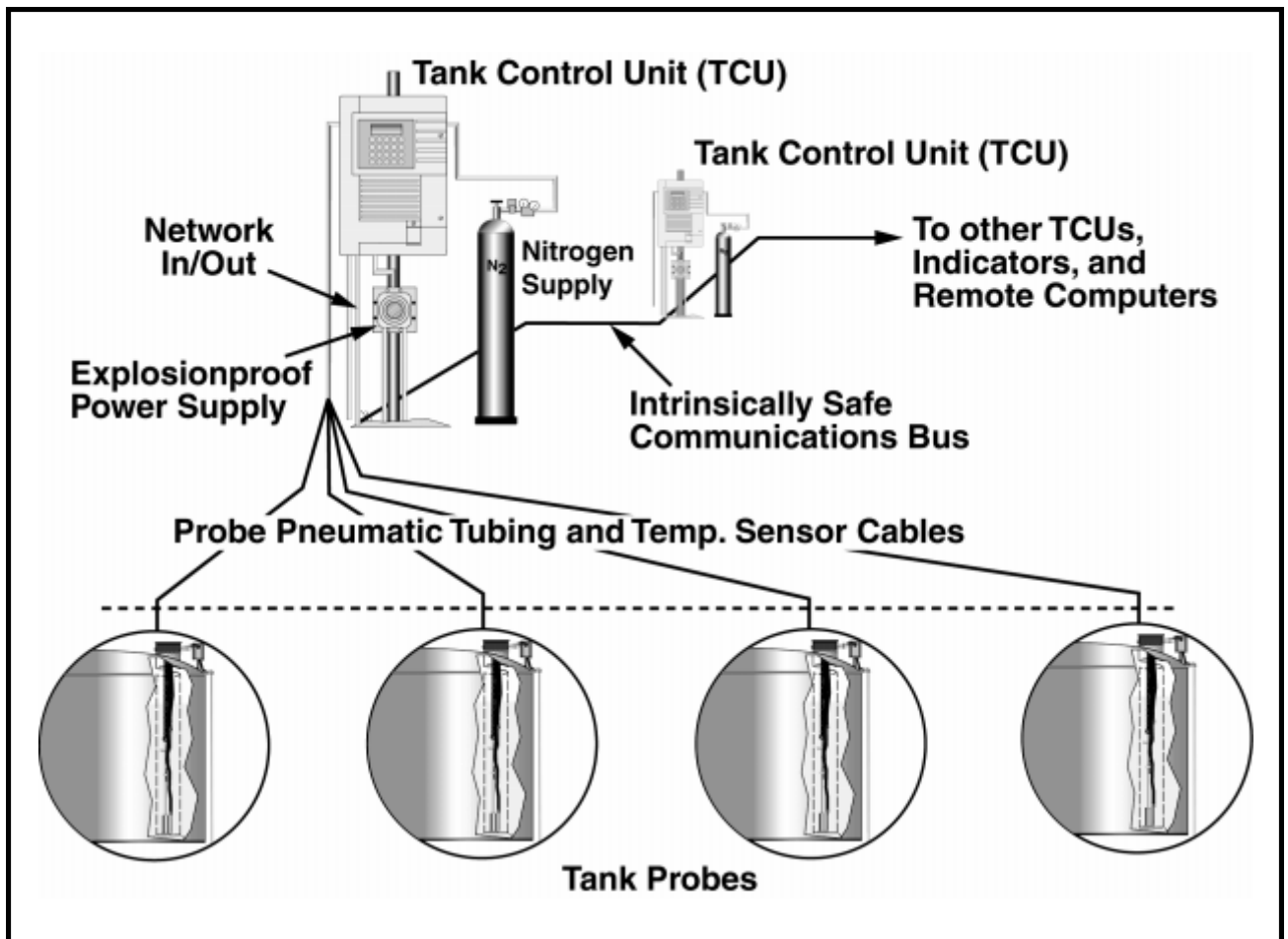


# ***Barton® Series 3500***

## ***Automatic Tank Gauging System***



***Installation and Operation Manual***

**Manual No. 97K15**

**INSTALLATION AND OPERATION MANUAL**  
**Series 3500**  
**Automatic Tank Gauging System**

**ITT Barton**  
**900 S. Turnbull Canyon Rd.**  
**City of Industry, CA 91745**  
**U.S.A.**

**©Copyright 1997, ITT Barton**

## PRODUCT WARRANTY STATEMENT

The product warranty applicable to this ITT Barton product is as stated on the inside back cover of this manual.

Should any after-delivery problems arise, please contact ITT Barton's Consumer Affairs office, during normal business hours, at (626) 333-4701.

## SAFETY

Before installing this product, become familiar with the installation instructions presented in Section 3.

**DANGER** notes indicate the presence of a hazard which **will** cause **severe** personal injury, death, or substantial property damage if the warning is ignored.

**WARNING** notes indicate the presence of a hazard which **can** cause **severe** personal injury, death, or substantial property damage if the warning is ignored.

**CAUTION** notes indicate the presence of a hazard which **will** or **can** cause **minor** personal injury or property damage if the warning is ignored.

**DANGER, WARNINGS, and/or CAUTIONS** appear on the following pages of this manual and should be reviewed before proceeding: **3-10**.

## RECORD OF CHANGES

Version	Date	Change	By
93C1	10/93	Format Update	M. La Gabed
94B8	2/94	Revised Procedure Table Illustrations; Replaced scanned wiring drawings with pict-image files; Added photographs to S-7 Maintenance; Revised calibration procedure - S-5 - Configuration; Revised TCU Screen Flowchart; Minor format and text revisions.	M. La Gabed
94G1	7/94	Updated for firmware version 2.03.xx	M. La Gabed
97K15	11/97	Updated for firmware version 4.02.xx	M. La Gabed



# TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
<b>SECTION 1</b>	
<b>INTRODUCTION</b>	
1-1 GENERAL INFORMATION .....	1-1
1-2 ITEMS FURNISHED .....	1-1
1-3 ADDITIONAL ITEMS REQUIRED .....	1-1
1-4 SHIPPING AND HANDLING .....	1-1
1-5 STORAGE REQUIREMENTS .....	1-1
1-6 MAIN SYSTEM COMPONENTS .....	1-1
1-6.1 Measurement Probe .....	1-2
1-6.2 Temperature Sensor/Cabling .....	1-2
1-6.3 Tank Control Unit (TCU) .....	1-2
1-6.4 Tank Top Junction Box .....	1-4
1-6.5 Power Supply (Explosionproof) .....	1-4
1-6.6 Communications Network .....	1-4
1-6.7 Pneumatic Tubing .....	1-5
1-7 SPECIFICATIONS .....	1-5
1-8.1 General .....	1-5
1-8.2 Operational .....	1-5
1-8.3 Component .....	1-5
1-8 INSTALLATION STEPS .....	1-5
<b>SECTION 2</b>	
<b>THEORY OF OPERATION</b>	
2-1 INTRODUCTION .....	2-1
2-2 AUTOMATIC ZERO CALIBRATION .....	2-1
2-3 SHORT TANK LEVEL MEASUREMENTS .....	2-2
2-4 VOLUME, TEMPERATURE, AND MASS CALCULATIONS .....	2-3
2-5 TALL TANK LEVEL MEASUREMENT .....	2-4
2-6 WATER MEASUREMENT .....	2-5
2-7 LEAK DETECTION .....	2-6
2-8 COMMUNICATIONS .....	2-6
2-9 SELF-CALIBRATION .....	2-6
<b>SECTION 3</b>	
<b>INSTALLATION</b>	
3-1 GENERAL INFORMATION .....	3-1
3-1.1 Unpacking Instructions/Inspection .....	3-1
3-1.2 Operating/Storage Limitations .....	3-1
3-2 PRE-INSTALLATION ITEMS .....	3-1
3-2.1 Site Preparation .....	3-1
3-2.2 User Supplied Data .....	3-1

# TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
3-3 INSTALLATION PROCEDURE.....	3-2
3-3.1 Overview.....	3-2
3-3.2 TCU/Assoc. Equip. Mounting.....	3-3
3-3.3 Probe Assembly and Installation .....	3-3
3-3.4 Mechanical Connections .....	3-7
3-3.5 Electrical Connections .....	3-10
3-4 POWER ON PROCEDURE.....	3-10

## **SECTION 4**

### **BASIC TCU OPERATION**

4-1 GENERAL .....	4-1
4-2 OVERVIEW .....	4-1
4-3 DISPLAY AND KEYPAD.....	4-1
4-3.1 Display.....	4-2
4-3.2 Keypad .....	4-2
4-4 OPERATING SYSTEM .....	4-2
4-4.1 Overview.....	4-2
4-4.2 Primary Page Functions .....	4-4
4-4.3 Main Menu .....	4-5
4-4.4 Operational Modes.....	4-5
4-4.5 Password Operation .....	4-5
4-5 UNIT AND TANK SELECTION.....	4-6
4-5.1 Overview.....	4-6
4-5.2 Network Access .....	4-6
4-6 CONTROL OPERATIONS.....	4-6
4-6.1 Moving the Cursor .....	4-6
4-6.2 Selecting Menu Choices.....	4-7
4-6.3 Making Choice Selections .....	4-7
4-6.4 Entering Labels, User Names, and Passwords .....	4-8
4-6.5 Entering Data .....	4-8
4-6.6 Returning to Previous Page.....	4-9
4-6.7 Cancel Entry.....	4-9
4-7 TCU PROCEDURES .....	4-10
4-7.1 Overview.....	4-10
4-7.2 Procedure Examples.....	4-11
4-8 TCU SCREEN FLOWCHART .....	4-15

## **SECTION 5**

### **SETUP AND VERIFICATION**

5-1 GENERAL .....	5-1
5-2 REMOTE TCU OPERATION .....	5-1
5-3 MULTIPLE TANKS .....	5-1
5-4 TCU SETUP STEPS.....	5-1

## TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
5-5 INPUT/SETTING PROCEDURES OVERVIEW .....	5-2
5-5.1 TCU Unit Number Assignment .....	5-2
5-5.2 Setup Procedures.....	5-2
5-6 TCU SETUP CHECKLIST .....	5-3
5-7 PASSWORDS .....	5-4
5-7.1 Change Master Password .....	5-4
5-7.2 Add Users/Passwords .....	5-7
5-8 LOGIN.....	5-10
5-9 UNIT SELECTION/LABEL.....	5-12
5-10 UNIT SETUP.....	5-14
5-10.1 Tank Types .....	5-15
5-10.2 Set Clock .....	5-17
5-10.3 Measurement Times.....	5-18
5-10.4 Measurement Units .....	5-20
5-10.5 Unit Values .....	5-22
5-11 TANK SELECTION/LABEL .....	5-30
5-12 TANK VALUES CONFIGURATION.....	5-32
5-12.1 Level Alarm Points.....	5-32
5-12.2 Volume (Vol) Alarm Points.....	5-34
5-12.3 Temperature (Temp) Defaults and Alarm Points.....	5-36
5-12.4 Density (Dens) Defaults and Alarm Points.....	5-38
5-12.5 Mass Alarm Points .....	5-40
5-12.6 Water Defaults and Alarm Points.....	5-42
5-12.7 Tank Setup .....	5-44
5-13 CALIBRATION.....	5-58
5-13.1 Single Point Calibration Procedure .....	5-58
5-13.2 Multiple Points Calibration Procedure .....	5-59
5-14 VERIFICATION .....	5-60
5-15 LOGOUT .....	5-60

## SECTION 6

### NORMAL OPERATION

6-1 GENERAL.....	6-1
6-2 LOGIN.....	6-1
6-3 LOGOUT .....	6-4
6-4 UNIT SELECTION .....	6-5
6-5 TANK SELECTION.....	6-6
6-6 TANK MEASUREMENT.....	6-8
6-7 VIEWING MEASUREMENT READINGS.....	6-10
6-8 ALARMS.....	6-11
6-8.1 Alarm Cursor .....	6-11
6-8.2 TCU Alarm List.....	6-11
6-8.3 Alarm Details .....	6-11
6-8.4 Acknowledge Alarms.....	6-11



# TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
6-9 TRANSFER .....	6-14
6-10 TANK LEAK/THEFT .....	6-17
<b>SECTION 7</b>	
<b>TROUBLESHOOTING AND MAINTENANCE</b>	
7-1 GENERAL .....	7-1
7-2 LIST OF TOOLS AND EQUIPMENT .....	7-1
7-3 ALARMS .....	7-1
7-3.1 Overview .....	7-1
7-3.2 Alarm Types .....	7-1
7-3.3 Configurable Alarms (Setpoints) .....	7-3
7-3.4 Diagnostic Alarms .....	7-3
7-4 TROUBLESHOOTING .....	7-4
7-4.1 General .....	7-4
7-4.2 Troubleshooting Tables .....	7-4
7-5 DIAGNOSTICS FUNCTIONS .....	7-9
7-5.1 Self-Diagnostics .....	7-9
7-5.2 Manual Diagnostics .....	7-9
7-5.3 Diagnostics Page Overview .....	7-9
7-5.4 Viewing Automatic Valve Operation .....	7-9
7-5.5 Valve Designations .....	7-10
7-6 MANUAL DIAGNOSTICS PROCEDURES .....	7-11
7-6.1 Overview .....	7-11
7-6.2 Auto-Zero .....	7-11
7-6.3 Hydrostatic Diagnostics Procedure .....	7-12
7-6.4 Density Diagnostics Procedure .....	7-14
7-7 TCU RESET PROCEDURES .....	7-16
7-7.1 Main Circuit Board .....	7-16
7-7.2 Memory Backup Battery Activation Procedure .....	7-16
7-7.3 Reset Procedure .....	7-17
7-7.4 “Superboot” Procedure .....	7-17
7-8 PERIODIC MAINTENANCE/INSPECTION .....	7-17
7-8.1 General .....	7-17
7-8.2 Inspection .....	7-17
7-8.3 Nitrogen Supply Replacement .....	7-17
7-9 COMPONENT REPLACEMENT .....	7-17
7-9.1 Replacement Items .....	7-17
7-9.2 Opening TCU Enclosure .....	7-18
7-9.3 Keypad/Display Assembly Replacement .....	7-18
7-9.4 Input Board Assembly .....	7-18
7-9.5 DPE .....	7-19
7-9.6 Main Circuit Board .....	7-20
7-9.7 Backup Battery Replacement .....	7-21
7-9.8 EPROM (program chip) .....	7-22
7-9.9 Solenoid Manifold .....	7-22

# TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
7-9.10 Solenoid Valve .....	7-23
7-9.11 Solenoid Valve Fuse .....	7-23
7-9.12 Power Supply .....	7-24
7-9.13 Temperature Sensors .....	7-25

## **SECTION 8**

### **PARTS LIST/DRAWINGS**

8-1	GENERAL .....	8-1
8-2	ASSOCIATED EQUIPMENT PARTS .....	8-1
8-2.1	Tank Top Junction Box .....	8-1
8-2.2	Network Barrier .....	8-1
8-2.3	Power Supply .....	8-1
8-2.4	Regulator Assembly .....	8-1

### **TCU SETUP CHECKLIST** (at back of manual)



# LIST OF FIGURES

<u>Title</u>	<u>Page</u>
<b>SECTION 1</b>	
<b>INTRODUCTION</b>	
Figure 1-1	TCU System Components..... 1-2
Figure 1-2	Typical TCU Installation ..... 1-2
Figure 1-3	TCU Faceplate ..... 1-3
Figure 1-4	TCU Main Circuit Board ..... 1-3
Figure 1-5	TCU Input Board ..... 1-4
Figure 1-6	TCU Manifold..... 1-4
Figure 1-7	Tank Top Junction Box Location ..... 1-4
Figure 1-8	Explosionproof Power Supply ..... 1-4
<b>SECTION 2</b>	
<b>THEORY OF OPERATION</b>	
Figure 2-1	Auto-Zero..... 2-1
Figure 2-2	Datum Point Reference/Probe Spring ..... 2-1
Figure 2-3	Short Tank Configuraton ..... 2-2
Figure 2-4	Short Tank Equations..... 2-2
Figure 2-5	DPE Sensor Output ..... 2-3
Figure 2-6	Vol./Den./Mass Calculations ..... 2-3
Figure 2-7	Tall Tank Configuration ..... 2-4
Figure 2-8	Tall Tank Calculations..... 2-4
Figure 2-9	Water Measurement ..... 2-5
Figure 2-10	Water Measurement Calculations ..... 2-5
<b>SECTION 3</b>	
<b>INSTALLATION</b>	
Figure 3-1	Typical TCU Installation ..... 3-2
Figure 3-2	Probe in Stilling Well..... 3-2
Figure 3-3	Typical 4-Tank Installation..... 3-2
Figure 3-4	Typical 6-Tank Installation..... 3-2
Figure 3-5	Tank Probe Types ..... 3-4
Figure 3-6	Tank Entry Adapter Types..... 3-5
Figure 3-7	Probe Chain Connection ..... 3-5
Figure 3-8	Probe Install Step 3 ..... 3-5
Figure 3-9	Probe Install Step 4 ..... 3-6
Figure 3-10	Probe Install Step 5 ..... 3-6
Figure 3-11	‘T’ Line Tube Connection ..... 3-6
Figure 3-12	TCU Manifold..... 3-7
Figure 3-13	Manifold Connection Label ..... 3-7
Figure 3-14	TCU Manifold Configurations..... 3-8
Figure 3-15	Wiring Drawing TS10-10513 (1/10) ..... 3-11
Figure 3-16	Wiring Drawing TS10-10513 (2/10) ..... 3-12
Figure 3-17	Wiring Drawing TS10-10513 (3/10) ..... 3-13
Figure 3-18	Wiring Drawing TS10-10513 (4/10) ..... 3-14
Figure 3-19	Wiring Drawing TS10-10513 (5/10) ..... 3-15

## LIST OF FIGURES

<u>Title</u>	<u>Page</u>
Figure 3-20	Wiring Drawing TS10-10513 (6/10).....
Figure 3-21	Wiring Drawing TS10-10513 (7/10).....
Figure 3-22	Wiring Drawing TS10-10513 (8/10).....
Figure 3-23	Wiring Drawing TS10-10513 (9/10).....
Figure 3-24	Wiring Drawing TS10-10513 (10/10).....

### SECTION 4

#### BASIC TCU OPERATION

Figure 4-1	Local Network (Linking TCUs/TDUs).....
Figure 4-2	Remote TCU Control .....
Figure 4-3	TCU Front Panel .....
Figure 4-4	TCU Display Window.....
Figure 4-5	Keypad .....
Figure 4-6	TCU Operating System Page Overview.....
Figure 4-7	Main Menu Page .....
Figure 4-8	TCU Unit Number/Label .....
Figure 4-9	Tank Number/Label .....
Figure 4-10	Moving Cursor to Top Line .....
Figure 4-11	Cursor Movement.....
Figure 4-12	Menu Selection.....
Figure 4-13	Scrolling .....
Figure 4-14	Choice Selections .....
Figure 4-15	Direct Key Entry (Numbers/Key Characters) .....
Figure 4-16	Entering Letters/Punctuation.....
Figure 4-17	Procedure Table Parts.....
Figure 4-18	Login Procedure Example .....
Figure 4-19	TCU Unit Number (Main Menu) .....
Figure 4-20	Unit Selection/Label Procedure Table Page Example .....
Figure 4-21	TCU Screen Flowchart.....

### SECTION 5

#### SETUP AND VERIFICATION

Figure 5-1	New Density Factor Calculation for Single Point Calibration.....
------------	--

### SECTION 6

#### NORMAL OPERATION

Figure 6-1	Alarm/Acknowledge Operation .....
Figure 6-2	Transfer Log Example.....
Figure 6-3	Leak/Theft Operation .....
Figure 6-4	Leak Log Example .....

# LIST OF FIGURES

<u>Title</u>	<u>Page</u>
<b>SECTION 7</b>	
<b>TROUBLESHOOTING AND MAINTENANCE</b>	
Figure 7-1	Diagnostics Page..... 7-9
Figure 7-2	Vlv Display Sequence..... 7-9
Figure 7-3	Vlv Condition Display ..... 7-9
Figure 7-4	‘W’ Line Connections..... 7-11
Figure 7-5	Main Circuit Board ..... 7-16
Figure 7-6	MEM Battery- DIP Switch Setting ..... 7-16
Figure 7-7	RESET - DIP Switch Setting ..... 7-17
Figure 7-8	“Superboot”- DIP Switch Settings..... 7-17
Figure 7-9	Opening TCU Enclosure..... 7-18
Figure 7-10	Display/Keypad Cover Plate..... 7-18
Figure 7-11	Display/Keypad Assembly (cover removed)..... 7-18
Figure 7-12	Input Board Assy. Location ..... 7-18
Figure 7-13	Input Box Cover/Latch ..... 7-19
Figure 7-14	Input Board Connections ..... 7-19
Figure 7-15	Input Box Conduit Ports ..... 7-19
Figure 7-16	Input Box Mounting Screws ..... 7-19
Figure 7-17	DPE Location..... 7-19
Figure 7-18	DPE to Main Board Cable ..... 7-19
Figure 7-19	DPE Pressure Sensing Lines..... 7-20
Figure 7-20	DPE Mounting Screws..... 7-20
Figure 7-21	TCU Main Board (Front/Back)..... 7-20
Figure 7-22	Main Board (Front) Cables ..... 7-20
Figure 7-23	TCU Board Door Panel Screws ..... 7-20
Figure 7-24	TCU Board (Back) Cables ..... 7-21
Figure 7-25	Main Board Support Screws ..... 7-21
Figure 7-26	Backup Battery Location ..... 7-21
Figure 7-27	Backup Battery Leads ..... 7-21
Figure 7-28	EPROM Chip Location..... 7-22
Figure 7-29	Solenoid Valve Manifold Location..... 7-22
Figure 7-30	Manifold Mounting Screws ..... 7-22
Figure 7-31	Valve Connector/Manifold Fittings ..... 7-23
Figure 7-32	Solenoid Components ..... 7-23
Figure 7-33	Installing Solenoid Valve..... 7-23
Figure 7-34	Solenoid Fuse Location..... 7-23
Figure 7-35	Power Supply Connections ..... 7-24
Figure 7-36	Power Supply Foam Cover ..... 7-24
Figure 7-37	Pwr. Board Stand-off and Mounting Screws ..... 7-24
Figure 7-38	Probe Temp. Sensor Location..... 7-25
Figure 7-39	Tank Top Box Enclosure ..... 7-25
Figure 7-40	Tank Top Box Temp. Probe..... 7-25

**LIST OF FIGURES**

<u>Title</u>	<u>Page</u>
<b>SECTION 8</b>	
<b>PARTS LIST/DRAWINGS</b>	
Figure 8-1      Series 3500 TCU Parts Drawing .....	8-4

# LIST OF TABLES

<u>Title</u>	<u>Page</u>
<b>SECTION 1</b>	
<b>INTRODUCTION</b>	
Table 1-1     Installation Steps .....	1-5
<b>SECTION 3</b>	
<b>INSTALLATION</b>	
Table 3-1     Tubing Color Code .....	3-3
Table 3-2     Tubing Connection Sequence .....	3-7
<b>SECTION 4</b>	
<b>BASIC TCU OPERATION</b>	
Table 4-1     Keypad Functions .....	4-2
Table 4-2     Primary Page Functions .....	4-4
<b>SECTION 5</b>	
<b>SETUP AND VERIFICATION</b>	
Table 5-1     Setup Phases.....	5-1
Table 5-2     Procedure Quick List .....	5-3
Table 5-3     Change Master Password Procedure.....	5-4
Table 5-4     Add/Edit Users/Passwords Procedure.....	5-7
Table 5-5     Login Procedure.....	5-10
Table 5-6     Unit Selection/Label Procedure .....	5-12
Table 5-7     Tank Types Procedure .....	5-15
Table 5-8     TCU Clock Procedure.....	5-17
Table 5-9     Measurement Times Procedure.....	5-18
Table 5-10    Measurement Units Procedure .....	5-20
Table 5-11    Unit Value Input Steps.....	5-22
Table 5-12    Unit Values Input Procedure.....	5-22
Table 5-13    Tank Selection/Label Procedure .....	5-30
Table 5-14    Tank Page Inputs.....	5-32
Table 5-15    Level Alarm Points Procedure .....	5-32
Table 5-16    Volume Alarm Points Procedure .....	5-34
Table 5-17    Temperature Alarm Points Procedure.....	5-36
Table 5-18    Density Alarm Points Procedure.....	5-38
Table 5-19    Mass Alarm Points Procedure.....	5-40
Table 5-20    Water Alarm Points Procedure .....	5-42
Table 5-21    Tank Setup Input Steps .....	5-46
Table 5-22    Probe Meas. vs Tank Type.....	5-46
Table 5-23    Tank Setup Values Input Procedure .....	5-47
Table 5-24    Tank Setup Values (Fine Tuning Calibration).....	5-58
Table 5-25    Logout Procedure.....	5-60



## LIST OF TABLES

<u>Title</u>	<u>Page</u>
<b>SECTION 6</b>	
<b>NORMAL OPERATION</b>	
Table 6-1	Normal Op. Procedures Summary ..... 6-1
Table 6-2	Login Procedure ..... 6-1
Table 6-3	Logout Procedure ..... 6-4
Table 6-4	Unit Selection Procedure..... 6-5
Table 6-5	Tank Selection Procedure..... 6-6
Table 6-6	Full Tank Measurement ..... 6-8
Table 6-7	View Measurement Procedure ..... 6-10
Table 6-8	View/Acknowledge Alarms Procedure..... 6-11
Table 6-9	Transfer Viewing Procedure ..... 6-15
Table 6-10	Tank Leak Test Procedure..... 6-18
<b>SECTION 7</b>	
<b>TROUBLESHOOTING AND MAINTENANCE</b>	
Table 7-1	Alarm Summary ..... 7-1
Table 7-2	TCU Display Troubleshooting..... 7-4
Table 7-3	TCU Network Troubleshooting ..... 7-5
Table 7-4	TCU Alarms Troubleshooting..... 7-5
Table 7-5	Valve Parameters..... 7-10
Table 7-6	Hydrostatic Diagnostics Procedure ..... 7-12
Table 7-7	Density Diagnostics Procedure ..... 7-14
<b>SECTION 8</b>	
<b>PARTS LIST/DRAWINGS</b>	
Table 8-1	Series 3500 TCU Parts List..... 8-1

# SECTION 1

## INTRODUCTION

### 1-1 GENERAL INFORMATION

This manual contains information for the installation, operation, maintenance, troubleshooting, and repair of the ITT Barton Series 3500 ATG Tank Control Unit.

The Series 3500 is an intrinsically safe inventory management system for above and below ground bulk product storage applications. Utilizing hydrostatic head measurement, the Series 3500 provides continuous monitoring of **volume**, **corrected volume**, **level**, **mass**, **density**, **corrected density**, **temperature**, and **water bottoms** — without periodic calibration. In addition, the system provides leak, overfill, and theft monitoring.

Tank Control Units (TCUs) can be networked — providing the capability of viewing and confirming any TCU's tank data from any other TCU on the same network.

The system also features remote communications capability, which allows monitoring, reporting, and setup from a central PC computer station running ITT Barton's **Series 3500 ATG PC Software** (See separate software manual).

### 1-2 ITEMS FURNISHED

#### Standard Items

- Tank Control Unit (TCU)
- Power Supply (Explosionproof)
- Measurement Probe/Temperature Sensor(s)
- Tank Top Junction Box
- Regulator Assembly

#### Network Components

- Network Barrier
- PC Connection Kit (for 3500 PC Software)

### 1-3 ADDITIONAL ITEMS REQUIRED

- Conduit
- Wiring (cabling)
- Pneumatic Tubing (TCU to Tank Top Box)
- Tank Entry Adapter
- Nitrogen Gas Cylinder (257 or 300 cu-ft. purified, grade MG4.8, w/CGA 580 valve)

### 1-4 SHIPPING AND HANDLING

The Series 3500 is properly packed for shipment at the factory. However, an inspection should be performed at the time of unpacking to detect any damage that may have occurred during shipment.

### 1-5 STORAGE REQUIREMENTS

#### Temperature

The instruments and components should not be subjected to ambient or operating temperatures outside of the unit's operating temperature range of -40°F to +160°F (see Specs., para. 1-7).

#### Static Electricity

The circuit boards should not be subjected to any source of external static electricity. Circuit boards returned to ITT Barton factory for repair must be properly packed for static protection or they will not be covered by the ITT Barton warranty.

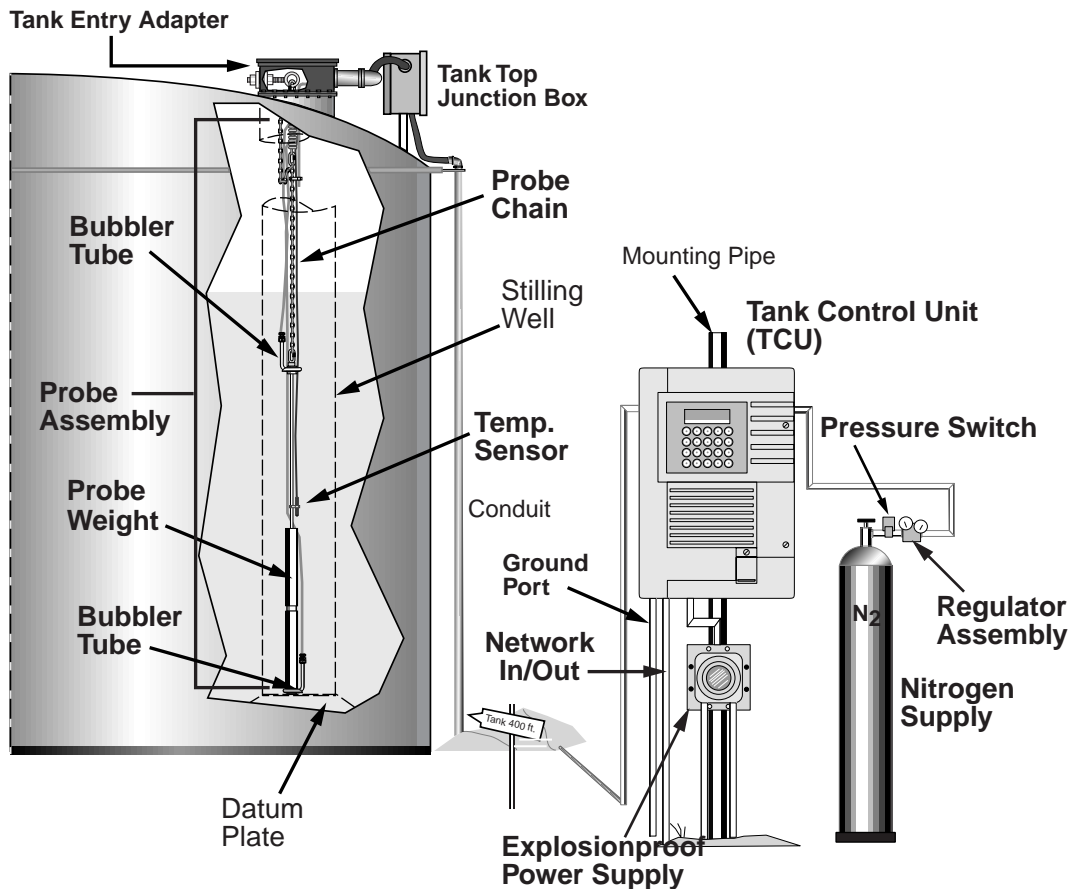
### 1-6 MAIN SYSTEM COMPONENTS

The Series 3500 has five main (see Figure 1-1) and two network components:

- Tank Control Unit (TCU)
- Power Supply (Explosionproof)
- Measurement Probe/Temperature Sensor(s)
- Tank Top Junction Box
- Regulator Assembly

#### Network Components

- Network Barrier
- PC Connection Kit



**Figure 1-1 TCU System Components**

### **1-6.3 Tank Control Unit (TCU)**

#### **1-6.1 Measurement Probe**

The Series 3500 measurement probe is intrinsically-safe — utilizing pneumatics to sense hydrostatic pressures and low-power solid-state temperature sensors to measure fuel and ambient temperatures.

It has a minimum of two pressure measurement points that are separated by a fixed distance. The measurement probe is lowered down the gauge well by a chain (min. gauge well diameter is 3-inches). The probe rests on the datum plate and is kept in place by the probe weight.

#### **1-6.2 Temperature Sensor/Cabling**

To provide corrected volume and tank expansion compensation, measurements are made with temperature sensors attached to the tank probe. The temperature sensor cables run parallel to the probe pneumatic tubing up to the Tank Top Junction Box. From there, a multiconductor cable runs within the conduit from the Tank Top Junction Box to the TCU.



**Figure 1-2 Typical TCU Installation**

### 1-6.3.1 Overview

The TCU contains mechanical and electronic components that control the Series 3500. It is intrinsically-safe — specifically designed to be installed in hazardous areas surrounding fuel storage tanks.

A single TCU can be used for measurement of two above-ground or four below-ground tanks. The TCU can be mounted up to 400 feet from the tank.

The TCU is communications capable, using a Local Network Configuration. TCUs can communicate with other TCUs, TDUs (Tank Display Unit - same as a TCU, except it does not contain solenoid valves), and a computer (if connected). The network is a fully distributed network where redundant network information is stored in each TCU and TDU. No master device is needed. Therefore, the status of any tank can be monitored from any TCU, TDU, or computer connected to the network.

#### NOTE

A Tank Display Unit (TDU) is used as a remote terminal device. It contains the same components as a TCU, except for solenoid valves.

The TCU's associated nitrogen gas supply is installed with a non-bleed regulator to maintain correct pressure (20 psi). During operation, the TCU monitors the nitrogen supply — when the supply pressure drops below 200 psi, the TCU displays an alarm — indicating approximately 1 month of nitrogen supply remains.

### 1-6.3.2 TCU Components

There are (5) main TCU components:

- Display/Keypad
- Main Circuit Board
- Differential Pressure Transducer
- Solenoid Valve Assembly
- Input Board

**Display/Keypad:** The TCU front enclosure door contains the unit's display and keypad. The display "window" can display up to 4 lines of alphanumeric characters at one time (up to 20 characters). Additional screen lines are displayed by scrolling the display lines up or down as needed.

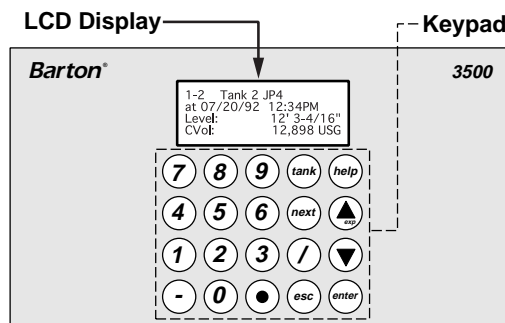


Figure 1-3 TCU Faceplate

**Main Circuit Board:** The Main Circuit Board contains the CPU, memory, dip switches, and network circuitry. The dip switches control several functions: reset, "superboot", and memory backup battery operation.

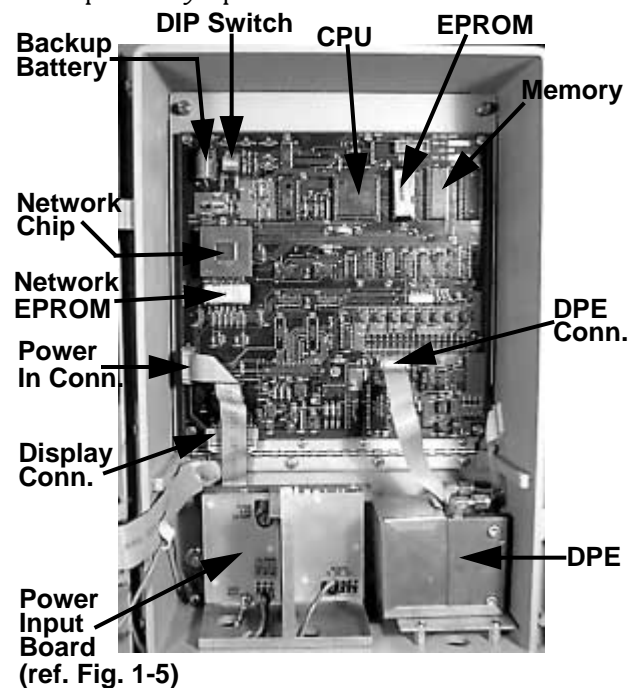


Figure 1-4 TCU Main Circuit Board

**Input Board:** The Input Board is housed in the bottom left corner inside the TCU enclosure. The board contains protective and noise suppression circuitry and is shielded by a metal box to protect the board from EMI. The left side has three terminals that take the voltage supplied by the power supply and generates voltages that are used by the TCU. Regulated voltages of +8, -5, and +5 volts are provided. In addition, Fuse F1 is located on the left side of the Input Board. The right side has six terminals to provide network communications termination.

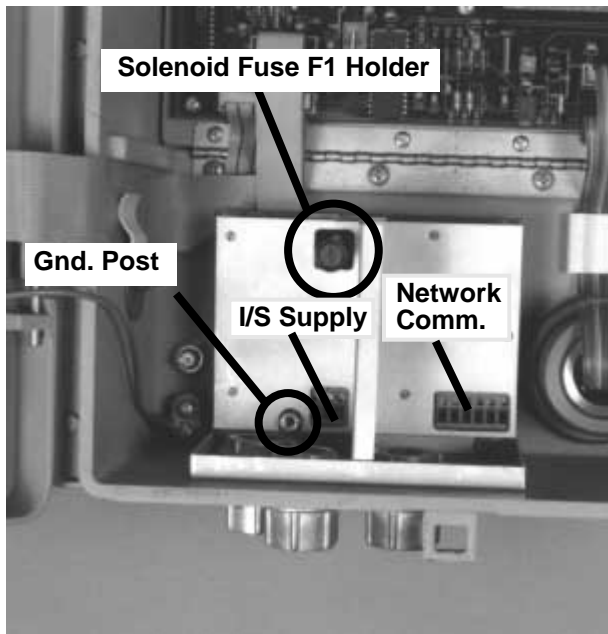


Figure 1-5 TCU Input Board

**Differential Pressure Transducer:** The intrinsically-safe Differential Pressure Transducer (DPT) is housed in the TCU enclosure. This prevents erroneous readings from RFI/EMI effects. The DPT measures DP and stores constants for temperature and pressure effects, and transfers data to the TCU for error compensation.

**Solenoid Valves:** The intrinsically-safe Solenoid Valve assembly is contained inside the TCU. Under TCU control, the solenoid valves regulate the flow of nitrogen gas to the various probes connected to the TCU. This allows the TCU to monitor/measure multiple tanks with a single DPT.

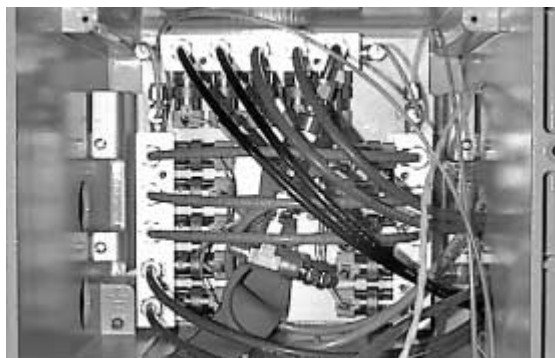


Figure 1-6 TCU Manifold

#### 1-6.4 Tank Top Junction Box

The Tank Top Junction Box is a weatherproof enclosure that is installed on the top of the fuel tank. It serves as a junction point for electrical wiring and pneumatic tubing between the TCU and the Tank Probe.

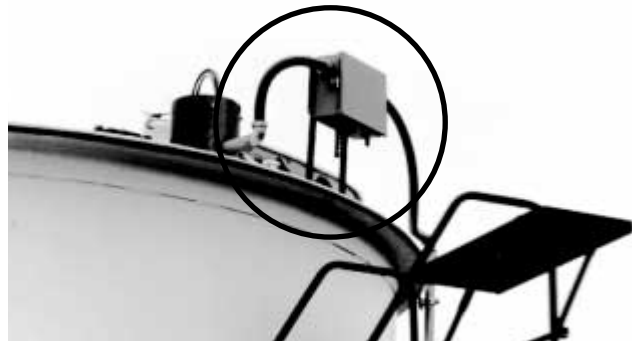


Figure 1-7 Tank Top Junction Box Location

#### 1-6.5 Power Supply (Explosionproof)

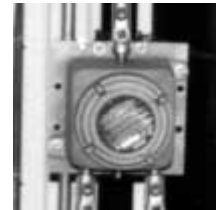


Figure 1-8 Explosionproof Power Supply

The explosionproof power supply allows all system components to be mounted in a Class I, Div. 1, Groups C&D hazardous area. It is normally mounted within 3-feet of the TCU, eliminating potential hazardous situations away from the tank. The power supply converts the 110/220 VAC site power to the intrinsically-safe 9-11 VDC power used by the TCU.

#### 1-6.6 Communications Network

The Series 3500 system uses a local communications network to link up to 100 devices TCUs and/or host computer together, in any combination. This provides remote operation, configuration, and monitoring of any TCU or tank on the network.

The network wiring is a single twisted-pair design that is intrinsically-safe, because voltage and current levels are limited to nonhazardous levels.

### 1-6.7 Pneumatic Tubing

The pneumatic tubing connects from the manifold in the TCU to each of the sensing tube connections in the Tank Top Junction Box. The pneumatic tubing is run inside conduit for physical damage protection only, since the Series 3500 is already intrinsically-safe.

## 1-7 SPECIFICATIONS

### 1-7.1 General

Operating Temperature Range .....	-40°F to +160°F
Max. System Pressure .....	50 psig
Operating System Pressure .....	20 psig
Humidity Limits .....	up to 100% RH
DC Power Output .....	9VDC I.S.
AC Power Input .....	110/220 VAC
Protection .....	Transient and Lightning

#### CSA Certification:

The TCU is intrinsically safe and can be used in Class I, Div. 1, Groups C&D hazardous environments for above-ground, below-ground, and cut and cover tanks.

### 1-7.2 Operational

Level Measurement Accuracy ...	±0.05 Inches
Corrected Volume Accuracy [at 60°F (15°C)] .....	±0.05%
Repeatability .....	±0.025 Inches
Temperature Accuracy .....	±1.0°F
Density Measurement Accuracy .....	±1.0% of reading

### 1-7.3 Component

TCU Display .....	4-line by 20-character LCD
Communications Network .....	Local Network
Network Capacity .....	up to 100 TCUs and (10) PCs
Network Chain Distance .....	up to 7,000 feet (end-to-end)
TCU to Tank Distance .....	400 feet max.
Nitrogen Tank Life (average) .....	1 yr. (typical with meas. interval of 2 minutes).
Power Supply Enclosure .....	Explosionproof

#### Measurement Probe

Metallic Material..... Stainless Steel (no copper, copper alloys, light metal alloys containing more than 4% copper, zinc, or zinc alloys, cadmium, lead or lead alloys are used).

## 1-8 INSTALLATION STEPS

Installation of the Series 3500 involves (8) basic steps, as listed in Table 1-1. Detailed information and instructions are given in Section 3 of this manual.

Table 1-1 Installation Steps

Step	Item	Section
1	Unpacking/Inspection	3-1.1
2	Pre-Installation	3-2
3	Mounting	3-3.2
4	Probe Assembly and Installation	3-3.3
5	Network Barrier Installation	3-3.3.6
6	Pneumatic Tubing/Sensor Cable Installation	3-3.3.7
7	Mechanical Connections	3-3.4
8	Electrical Connections	3-3.5

For installation of **PC Connection Kit**, refer to the Series 3500 ATG PC Software Manual.



## SECTION 2

### THEORY OF OPERATION

#### 2-1 INTRODUCTION

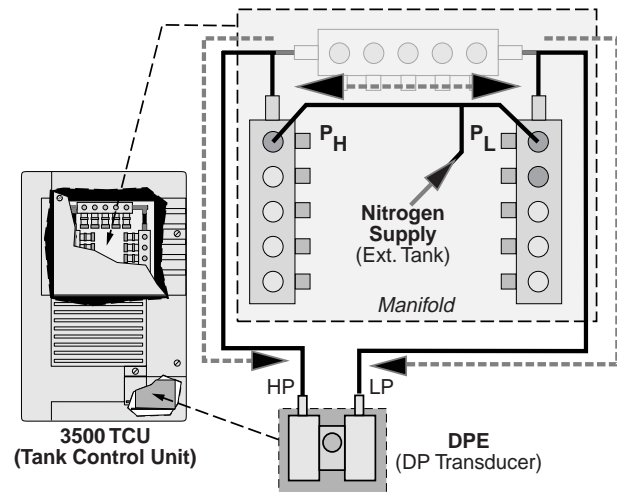
The Barton Series 3500 is based on a unique hydrostatic pressure measurement technology that eliminates the dependence upon pressure sensor accuracy and calibration — eliminating the need for periodic calibration and associated system maintenance.

The Series 3500 System's design eliminates errors found in other systems. The result is level measurement accuracy to within 0.05 inches. In addition, temperature measurements are used to correct the volume measurement for fluid expansion back to volume at a base temperature of +60°F (+15°C) to an accuracy of 0.05%.

#### 2-2 AUTOMATIC ZERO CALIBRATION

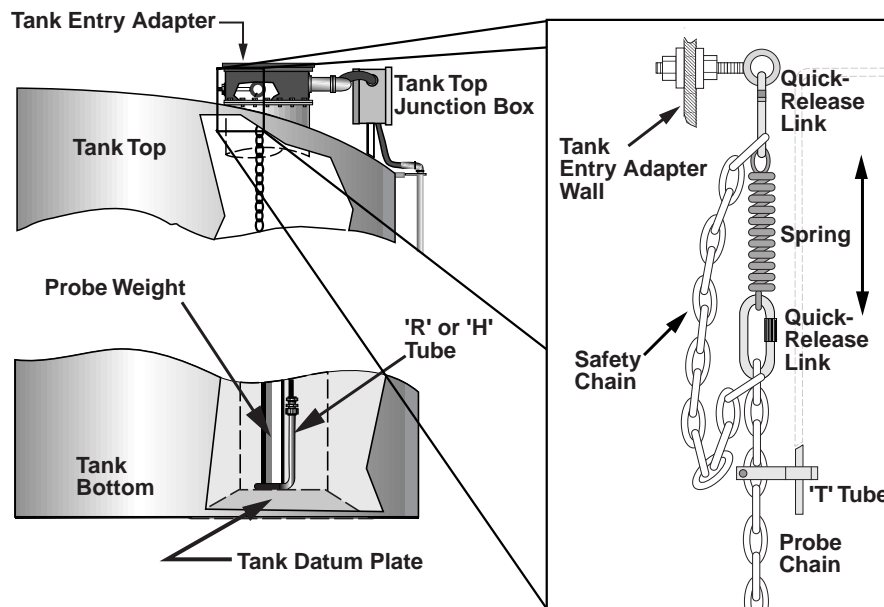
The Series 3500 system periodically performs an automatic DPE sensor zero calibration (eliminating errors caused by changes in ambient temperature, static pressure, and sensor drifts that occur over time).

This is accomplished by opening both the high and low purge ports (see Figure 2-1) and measuring the output. This “zero effect” is then subtracted from actual pressure measurements.



**Figure 2-1 Auto-Zero**

As shown in Figure 2-2, the Series 3500 uses the tank's datum plate (when available) as its reference point. All measurements are made from the datum plate up to the fuel surface. A spring at the top of the probe eliminates errors caused by vertical tank expansion and tank top movement.



**Figure 2-2 Datum Point Reference/Probe Spring**



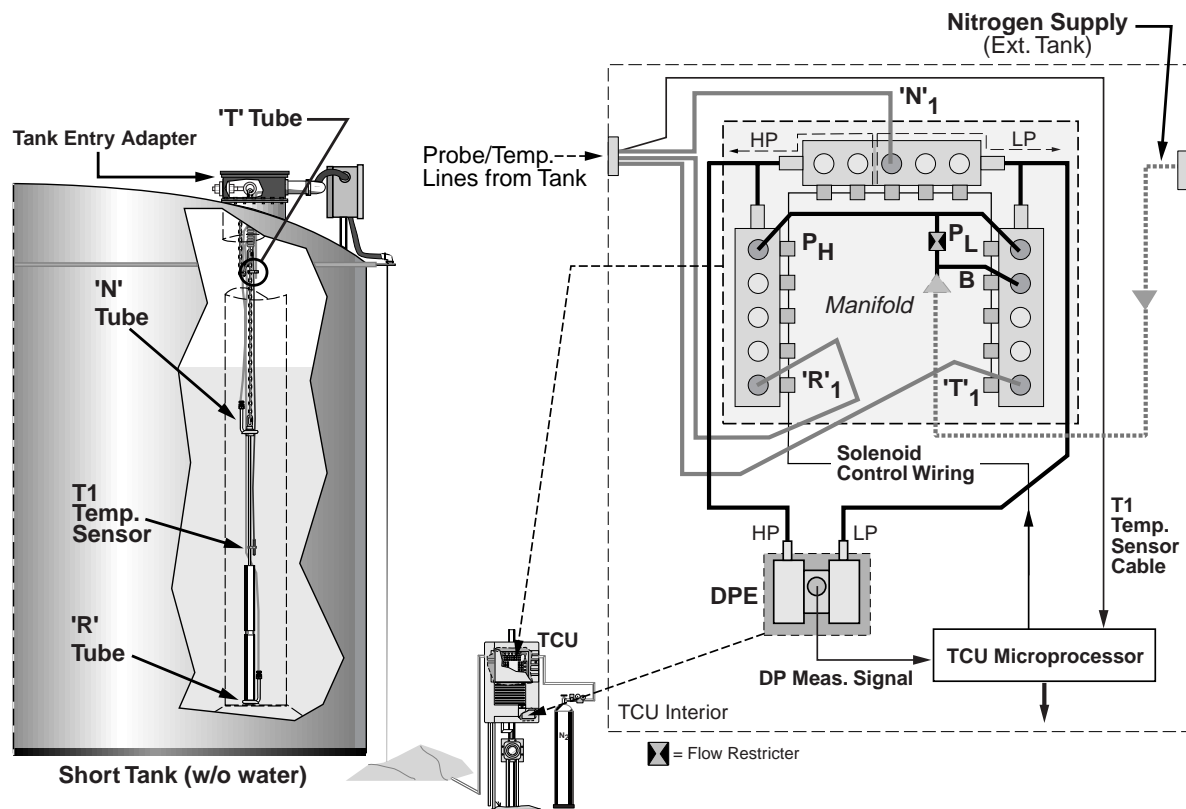


Figure 2-3 Short Tank Configuration

### 2-3 SHORT TANK LEVEL MEASUREMENTS

The first measurement performed is the fuel hydrostatic head. The high pressure (HP) side of the DPE is connected via a pneumatic line, through solenoid 'R', to the probe reference sensing tube 'R' (see Figure 2-3). The low pressure (LP) side is connected via solenoid 'T' to the 'T' tube at the top of the tank. This measures any pressure/vacuum changes in the tank top area. Solenoid valves 'P<sub>H</sub>' and 'R' are opened by the TCU, allowing a flow of nitrogen to charge the DPE's HP line connected to point 'R'. The pressure will increase until it is equal to the hydrostatic pressure of the fuel (plus frictional line loss) above the reference point 'R'. This pressure is monitored by the DPE (see Figure 2-5).

At the stable peak output, 'P<sub>H</sub>' is closed, locking in the nitrogen charge pressure. The system pressure then achieves a natural balance exactly equal to the hydrostatic pressure developed by the fuel. This hydrostatic value is stored in the TCU.

To calculate the level, the density of the fuel along with the hydrostatic head must be determined (see Figure 2-4). Product density is determined by adding a second tube 'N', at the known distance above 'R'. The TCU automatically closes solenoid valve 'T', and opens 'P<sub>L</sub>' and 'N'.

The differential pressure measurement between points 'N' and 'R' is proportional to the density of the fuel.

$$\text{Short Tank Level} = \frac{R_{toT} \text{Press}}{R_{toN} \text{Press}} \times [(N_{toBot} - R_{toBot}) + R_{toBot}]$$

$$\text{API} = \frac{141.5}{\text{SG}} - 131.5$$

$$\text{ShortTankActualRelativeDensity(SG)} = \frac{R_{toN} \text{Press}}{N_{toBot} - R_{toBot}}$$

**Note:** All measurements are based on the bottom reference.

Figure 2-4 Short Tank Equations

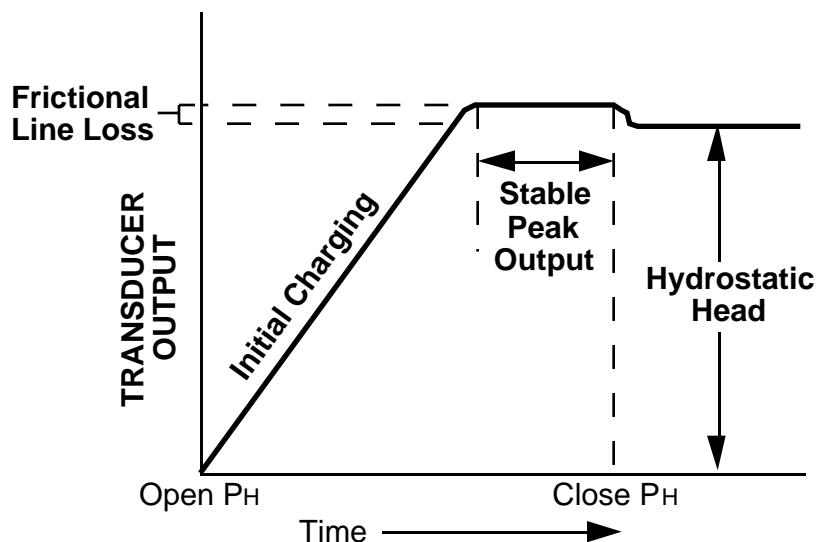


Figure 2-5 DPE Sensor Output

## 2-4 VOLUME, TEMPERATURE, AND MASS CALCULATIONS

After the level has been calculated, the actual volume is determined from the tank strapping table, previously entered into the TCU. A temperature measurement between the density measurement points is used to correct the volume to a base temperature, normally 60°F (15°C), see Figure 2-3. The mass of fluid in the tank is calculated from the corrected volume and the corrected specific gravity.

<u>Actual Volume</u>	determined from the strapping table entered into the TCU.
<u>Corr. Volume</u>	Actual Vol. x Vol. Corr. Factor
<u>Corr. Density</u>	Actual Density (Operating Temperature) corrected back to 60°F (15°C).
<u>Mass</u>	Mass=(Corr. Vol. x Corr. Rel. Density) x Water Density
<u>API Conversion</u>	$API = \frac{141.5}{SG} - 131.5$

Figure 2-6 Vol./Den./Mass Calculations

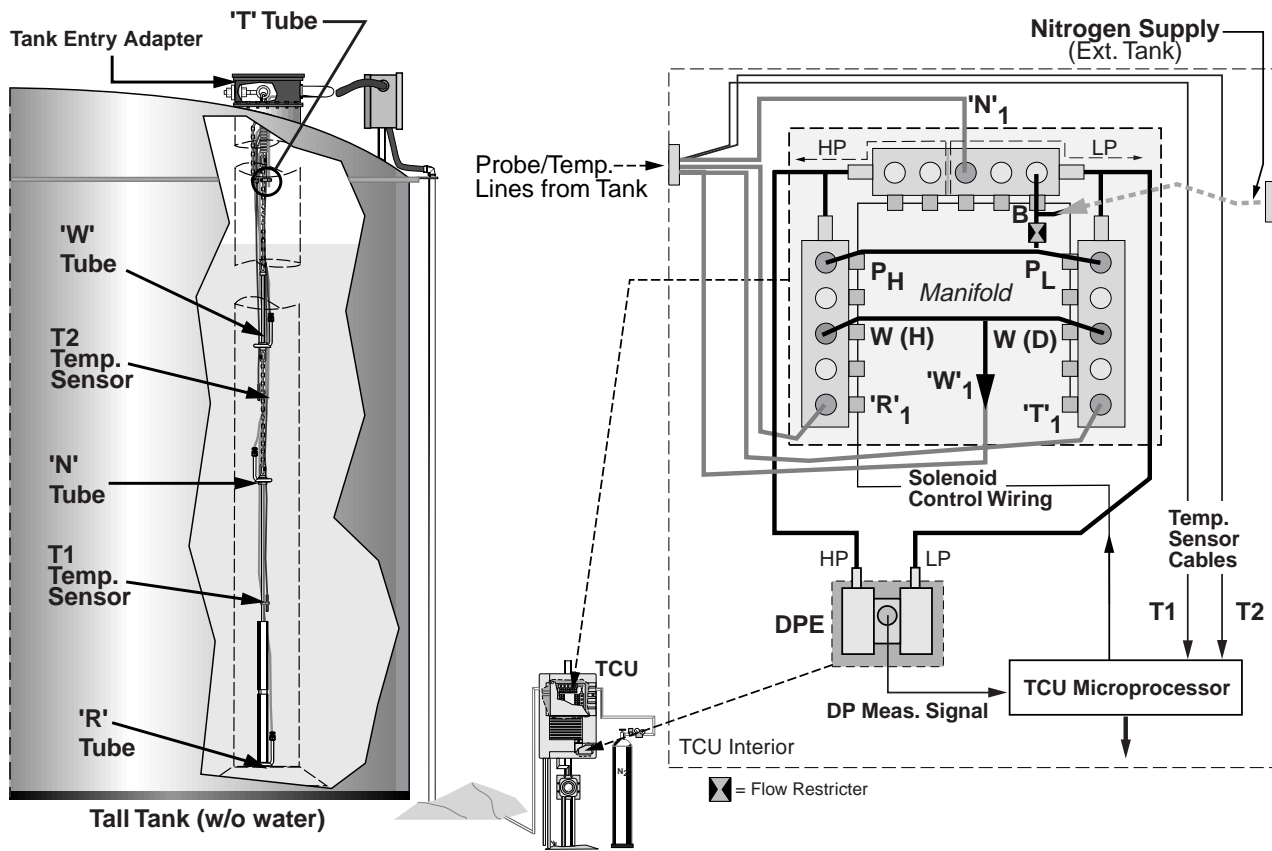


Figure 2-7 Tall Tank Configuration

## 2-5 TALL TANK LEVEL MEASUREMENT

On tall tanks, small errors in density measurement can develop from fluid stratification. These and other accumulated errors are eliminated with an additional sensing tube on the Series 3500 probe at a known position above the datum plate called 'W'. When the fluid rises above point 'W', the

hydrostatic measurement and density is referenced to this point. This is like starting over with a second system measuring the top part of the tank, independent of the lower portion of the tank — see Figure 2-7.

$$\text{TallTankLevel} = \frac{W_{toT} \text{Press}}{R_{toW} \text{Press}} \times [(W_{toBot} - R_{toBot}) + W_{toBot}]$$

$$\text{TallTankActualRelativeDensity(SG)} = \frac{R_{toW} \text{Press}}{W_{toBot} - R_{toBot}}$$

$$\text{API} = \frac{141.5}{\text{SG}} - 131.5$$

**Note:** All measurements are based on the bottom reference.

Figure 2-8 Tall Tank Calculations

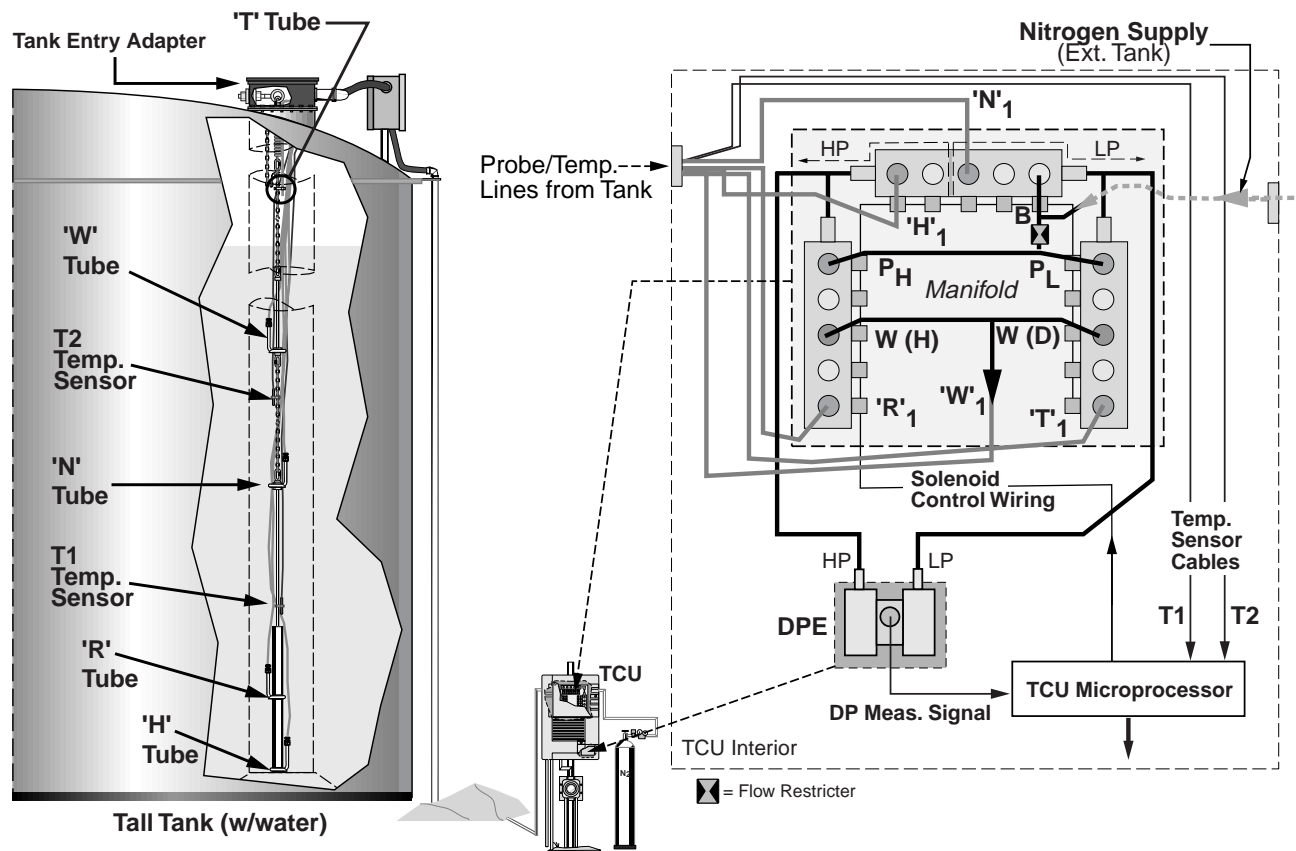


Figure 2-9 Water Measurement

## 2-6 WATER MEASUREMENT

To measure the level of water at the bottom of a tank, an additional probe called 'H' is added to the Series 3500 probe at a known distance below 'R'. The hydrostatic pressure from the 'H' sensing probe will vary in proportion to the amount of water above this point (see Figure 2-9).

$$\text{WaterLevel} = \frac{\left( \frac{\text{HtoNPress}}{\text{NtoBot} - \text{HtoBot}} \right) - \left( \frac{\text{RtoNPress}}{\text{NtoBot} - \text{RtoBot}} \right)}{\text{WaterSG} - \left( \frac{\text{RtoNPress}}{\text{NtoBot} - \text{RtoBot}} \right)} \times (\text{NtoBot} - \text{HtoBot})$$

**Note:** All measurements are based on the bottom reference.

Figure 2-10 Water Measurement Calculations

## 2-7 LEAK DETECTION

The Series 3500 leak detection function conforms to Federal Regulation 40 C. F. R., Part 280.43, Part D for underground tanks. This regulation states that hydrostatic ATG systems should be capable of detecting a minimum leak rate of 0.2 gallons per hour at any portion of the tank that contains product.

To perform a meaningful leak test with level measurement devices, a tank must be isolated and tested over a period of time. The length of time is dependent on the sensitivity and repeatability of the measurement system and the surface area of the product in the tank.

## 2-8 COMMUNICATIONS

The Series 3500 uses a local network configuration for communication between TCUs, TDUs, and a PC computer (if connected). The network is fully distributed, with redundant network information stored in each TCU/TDU on the network — eliminating the need for a dedicated “Master” control unit.

A major benefit of this type of system is that the data and status of any tank can be monitored from any TCU, TDU, or computer connected to the network. In addition, decentralized network operations ensure system reliability, even in the event of multiple unit failures or unit out-of-service conditions.

The network uses a daisy-chain configuration, with each unit connected “in-line” with other units. The “chain” can be up to 7,000 feet long (end-to-end).

Since the Series 3500 network is intrinsically-safe, a separate Network Barrier is required to extend the network outside of the hazardous area for connection to TDUs, modems, and a computer located in the safe area.

The Network Barrier also functions as a repeater, extending the range of the network an additional 7,000 feet.

The Network Barrier is housed in an explosionproof enclosure for installations in hazardous areas. It can also be installed in safe areas.

Conversion of the network signals to RS-232C is provided by the **PC Connection Kit**.

## 2-9 SELF-CALIBRATION

The TCU also makes several self-calibration checks. Every measurement cycle includes a step that calibrates the electronics to the equivalent full-scale output of the sensor. This is accomplished by switching the reference current that normally drives the sensor to a highly stable precision resistor that produces a signal equivalent to the sensor full-scale output. The actual measured transducer output is then normalized to this internal calibration level.

The temperature electronics are also self-calibrating. The precision 15-bit analog to digital converter incorporates an auto-zero function. The auto-zero function effectively combines the temperature inputs to correct for any zero offsets. The full-scale value is self-calibrated by measuring the reference voltage to the temperature sensors. The values of the measured “zero offset” and reference voltage are then used to correct the temperature measurements for errors and drift.

Since these self-calibrating functions occur each measurement cycle, errors from all of these sources are eliminated, even those resulting from ambient temperature changes from -40°F to over +160°F.

## SECTION 3

### INSTALLATION

#### 3-1 GENERAL INFORMATION

##### 3-1.1 Unpacking Instructions/Inspection

ITT Barton instruments are carefully inspected during manufacture and prior to shipment. However, an inspection should be performed at the time of unpacking to detect any damage that may have occurred during shipment.

The following standard items are included with each shipment:

- Tank Control Unit (TCU)
- Tank Probe(s)
- Tank Top Junction Box(es)
- Explosionproof Power Supply
- Regulator Assembly
- Installation and Operation Manual

The following optional items may be included, if ordered:

- PC Connection Kit
- Network Barrier

##### 3-1.2 Operating/Storage Limitations

Temperature:

The instruments and components should not be subjected to ambient or operating temperatures beyond the range listed in the specifications.

Static Electricity:

The circuit boards should not be subjected to any source of external static electricity. Circuit boards returned to ITT Barton factory for repair must be properly packed for static protection or they will not be covered by the ITT Barton warranty.

#### 3-2 PRE-INSTALLATION ITEMS

##### 3-2.1 Site Preparation

The Series 3500 should be laid out with hazardous and safe areas clearly defined. The mounting location of a TCU is not to exceed 400 feet from any tank connected to the TCU. Distances between TCUs/TDUs are not to exceed 7000 feet.

The following items should be available and/or in place:

- **Nitrogen gas cylinder** (257 or 300 cu. ft., purified grade MG 4.8, with CGA 580 valve)
- **Mounting pads** for TCUs and Nitrogen cylinders
- **Mounting pad** for Network Barrier (when used)

##### 3-2.2 User Supplied Data

The following data is required for configuration of a Series 3500 TCU:

- Master Password
- User Names/Passwords
- Unit and Tank Labels
- Unit Setup Values/Settings
- Tank Setup Values/Settings
- Strapping Table Data

#### NOTE

For a setup worksheet containing a list of values and settings, see the TCU Setup Checklist at the end of this manual.

##### 3-2.2.1 Strapping Table data

Strapping table data can be input into a TCU by two methods:

Data Transfer

Strapping table data can be stored on disk and transferred to a TCU with a PC (or laptop). See the Series 3500 ATG PC Software Manual for instructions on transferring strapping table data files.

Manual Input

The strapping table can also be manually entered into the TCU through the TCU's keypad. See Section 5 for manual input procedures.

### 3-3 INSTALLATION PROCEDURE

#### 3-3.1 Overview

A typical Series 3500 Control Unit (TCU) installation is illustrated in Figure 3-1.



Figure 3-1 Typical TCU Installation

Figure 3-2 illustrates a probe mounted in a stilling well.

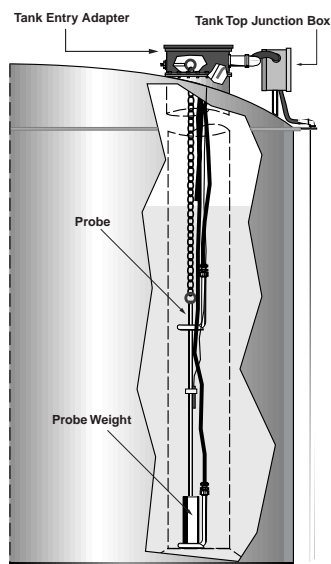


Figure 3-2 Probe in Stilling Well

Figure 3-3 shows a typical installation of components on four below-ground fuel tanks.

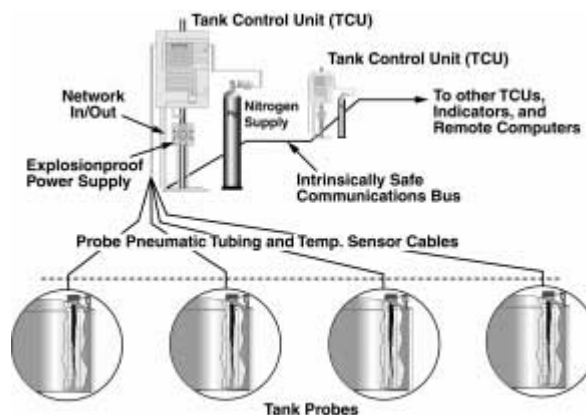


Figure 3-3 Typical 4-Tank Installation

One of the TCUs can be located in the control room, eliminating an additional remote display unit. If the distance from the tank to the control room is greater than 400 feet, a remote Tank Display Unit (TDU) is required.

On systems having more than 2 tanks taller than 25 feet, or more than 4 tanks (3 tanks with water measurement) under 25 feet, additional TCUs are required. The communications network allows viewing of any tank on the system from any TCU.

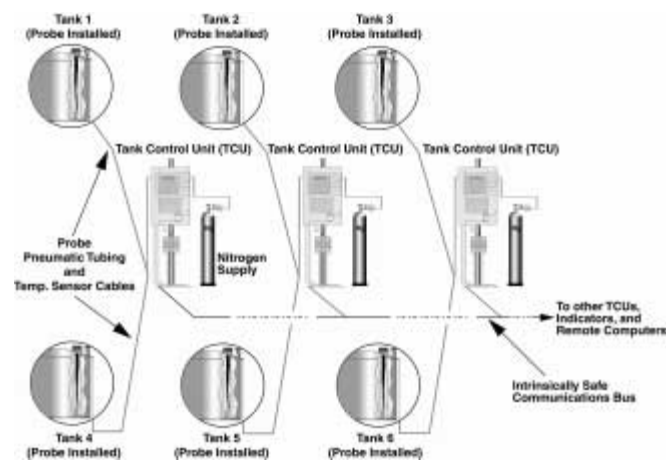


Figure 3-4 Typical 6-Tank Installation

Figure 3-4 shows an Series 3500 installation site with six large bulk tanks. All TCUs are connected together by the network.

Again, if one TCU can be placed in the control room (within 400 feet of any tank), it could act as a display unit for all tanks in the group.

The network system can also communicate by means of the PC Connection Kit. Transmission distance of the RS-232 is limited to 50 feet.

### **3-3.2 TCU/Assoc. Equip. Mounting**

#### **3-3.2.1 TCU/TDU, Power Supply, and Nitrogen Supply Cylinder**

Figure 3-1 shows a typical mounting installation of a TCU, power supply, and nitrogen supply.

##### **3-3.2.1.1 TCU/TDU**

A universal 2-inch pipe/wall mount bracket is provided with each TCU and TDU. Refer to outline-dimension drawing in Section 8. The 2-inch pipe should be mounted in a concrete pad to provide adequate support. Mount the TCU/TDU at a level that allows easy access of the internal components and readability of the screen.

##### **3-3.2.1.2 Power Supply**

The power supply assembly is housed in an explosionproof enclosure. It is also provided with a 2" pipe mount bracket, refer to outline-dimension drawings in Section 8. The power supply must be mounted within (9) feet of the TCU or TDU.

##### **3-3.2.1.3 Network Barrier**

The network barrier is housed in an explosion proof enclosure and requires 115/230 VAC power. It is provided with a 2-inch pipe mount bracket, but can also be wall mounted. Explosion proof conduit is required for the AC voltage line and the network communication line to the safe area. See the Network Barrier I.S. Installation Diagram in Section 8.

##### **3-3.2.1.4 Nitrogen Supply Cylinder**

Either the TCU mounting pipe or a separate support can be used to secure the nitrogen supply cylinder. The nitrogen supply cylinder must be adequately secured for personnel safety.

With the nitrogen cylinder mounted, the regulator assembly can be installed. Flexible 1/2-inch conduit is connected from the TCU upper right side to the regulator assembly junction box. The supply line and low pressure switch wires run through the conduit. 1/4-inch Poly-flo tubing can be used as the supply line to the TCU.

A short piece of spring armor is provided with the regulator assembly to protect the exposed tubing between the regulator outlet port and junction box. Insert the tubing through the bored-thru compression fitting on the junction box continuing until inside the TCU. Place the spring armor over the tubing then insert the tube into the regulator outlet port compression fitting.

Tighten the fitting nut 1-1/4 turns from finger tight. Pull the supply tube within the TCU then finger tighten the bored-thru fitting on the junction box.

#### **3-3.2.2 Tank Top Junction Box Mounting**

Because of the varying types of tank top openings and gauging hatches, the mounting of the tank top junction box will be dependent on specific site specifications. In general, the tank top junction box is to be mounted as close to the tank top opening or gauge hatch as possible. It must be mounted in accordance with applicable local electrical codes. Any suitable structure can be used to mount the box as long as it does not pose a safety hazard. Install a lightning ground wire, per Fig. 3-14 (Eng. drawing No.: TS10-10513).

### **3-3.3 Probe Assembly and Installation**

#### **3-3.3.1 Overview**

The Series 3500 Tank Probe is shipped ready for installation. The probe is suspended from an eyebolt using a tensioning spring. Pneumatic tubing and temperature sensor wires are routed through one-inch flexible conduit to the Tank Top Junction Box.

**Table 3-1 Tubing Color Code**

TUBING DESIGNATION	COLOR
Tank Top ('T')	Yellow
Wide Range ('W')	Orange or Gray
Narrow Range ('N')	Red
Reference ('R')	Brown or Blue
Water Measurement ('H')	Black

There are 10 main probe types (4-short tank and 6-tall tank). Probes are configured either with (w/w) or without (w/o) water measurement, as indicated in Figure 3-5.



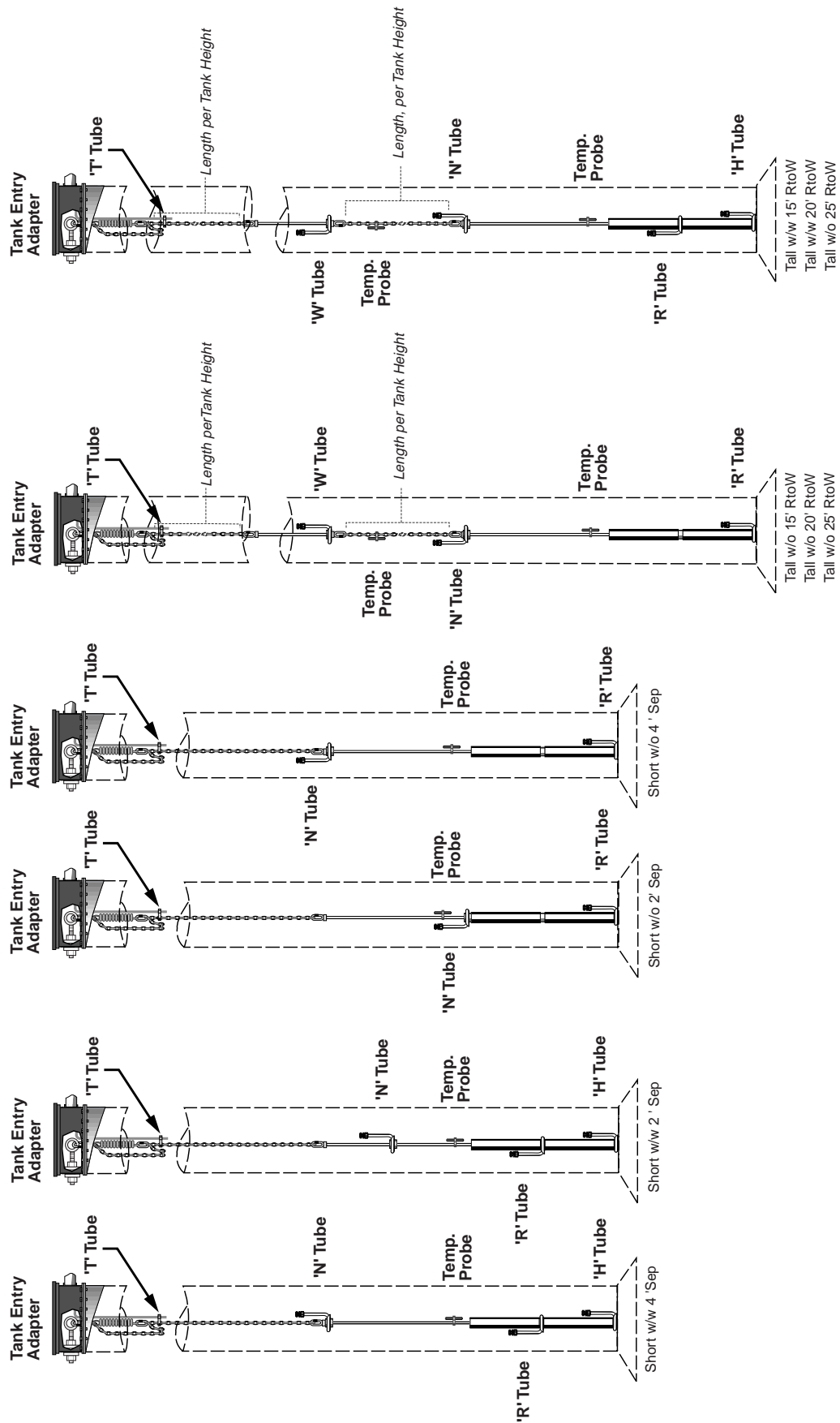
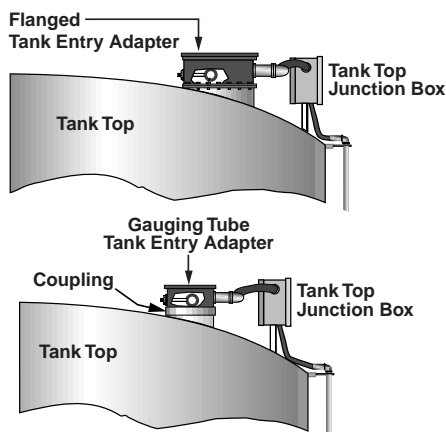


Figure 3-5 Tank Probe Types

### 3-3.3.2 Probe Installation

#### 3-3.3.2.1 Preliminary Items



**Figure 3-6 Tank Entry Adapter Types**

1. A mounting hole (for eyebolt) and an access hole (for 1-inch conduit) are required.
2. To eliminate drilling or welding on the tank, a Tank Entry Adapter should be pre-fabricated (using a flanged spool piece or threaded pipe coupling). A 3/8-inch mounting hole is required for the 5/16-18 eyebolt and either a threaded or welded 1-inch conduit adapter. (See Figure 3-6).

#### NOTICE

The eyebolt should be positioned directly above the intended probe position. In installations with floating-roof tanks, eyebolt ring should be centered over the opening.

3. On Tall Tank probes, mark the end of the upper temp. probe wire to differentiate it from other temperature probe wire(s).
4. Remove paper tag from probe and save for reference. This tag lists probe dimensions (entered into the Tank Setup Page), the probe serial number, and a register number.

#### NOTE

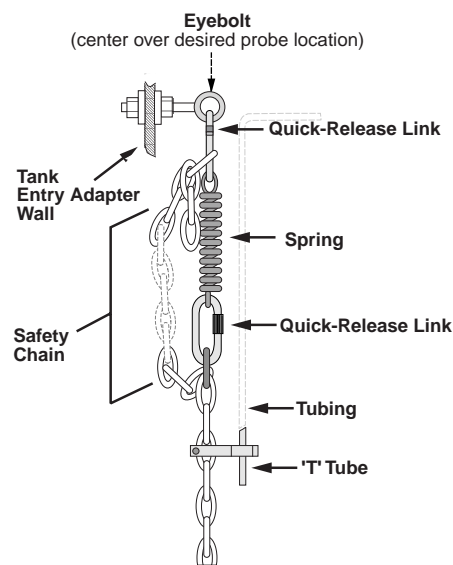
Dimensions/serial number are etched on the lower weight assembly of each probe.

#### 3-3.3.2.2 Procedure

1. Install Tank Entry Adapter and eyebolt.

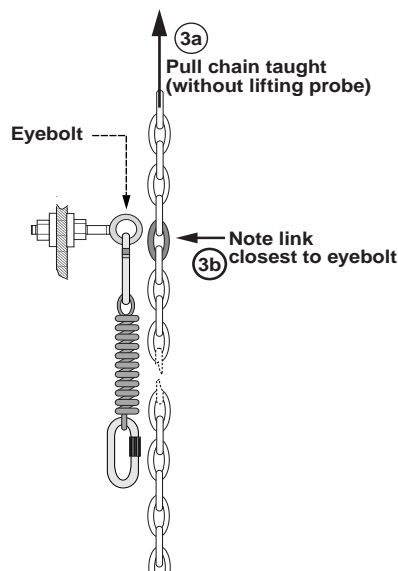
#### NOTICE

A small tank may not have enough space to install the probe with eyebolt in place.



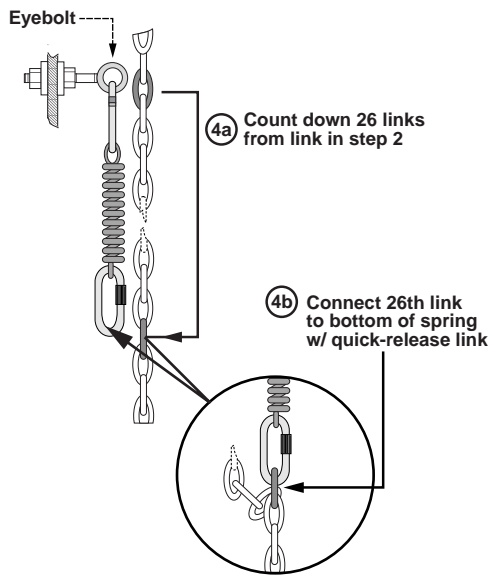
**Figure 3-7 Probe Chain Connection**

2. Install the spring to the eyebolt, using one of the quick-link connectors provided.



**Figure 3-8 Probe Install Step 3**

3. Lower the probe through the tank entry until it rests on the datum plate or tank bottom. Pull the chain to remove all slack without lifting the probe off the bottom of the tank, and note the link that is closest to the eyebolt ring.

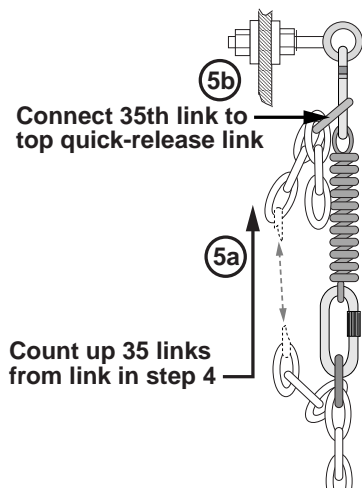


**Figure 3-9 Probe Install Step 4**

4. Count down (26) links from the link noted in step 4 and connect the lower end of the spring to link number (26) using 2nd quicklink connector.

**NOTE**

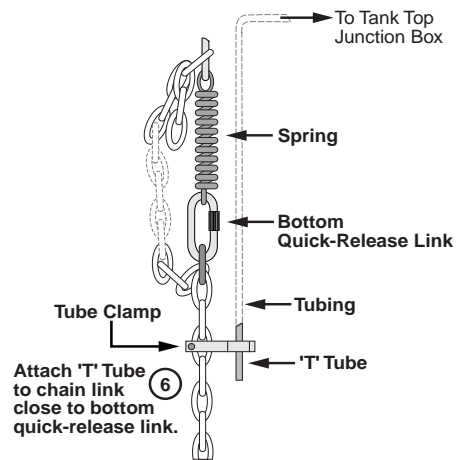
A spring scale can be used to check for proper spring tension. Lift probe assembly from bottom of spring with spring scale, it should require 5-10 pounds to just lift probe clear of the datum plate or tank bottom.



**Figure 3-10 Probe Install Step 5**

5. Count up (35) links from where the chain is connected below the spring. Connect the 35th link to the quicklink at the eyebolt.

6. Attach the 'T' probe tube (using supplied clamp) to chain just below the bottom quick-release link, as shown in Figure 3-9.
7. Insert the probe tubing and temperature cables through the Tank Entry Adapter and flexible conduit to the Tank Top Junction Box. See para. 3-3.3.3.



**Figure 3-11 'T' Line Tube Connection**

**3-3.3.3 Pneumatic Tubing/ Temperature Sensor Cable Installation**

The pneumatic tubing and temperature probe cables from the TCU to the Tank Top Junction Box should be run inside 1-inch rigid or reinforced flexible conduit. The recommended pneumatic tubing is 1/4-inch Poly-flo in colors matching probe assembly tubing. The recommended temperature sensor cable is a 4-conductor, 22-gauge stranded wire with shield.

**NOTICE**

Care should be taken when pulling tubing and cable through the conduit to prevent kinking or cutting of tubing and cables. Use of an adequate lubricant is recommended.

**NOTICE**

The Maximum distance between the TCU and Tank is 400 feet.

### 3-3.4 TCU Mechanical Connections

The mechanical connection portion of installation consists of connecting the pneumatic tubing running from manifold (inside the TCU) to the connections inside the Tank Top Junction Box.

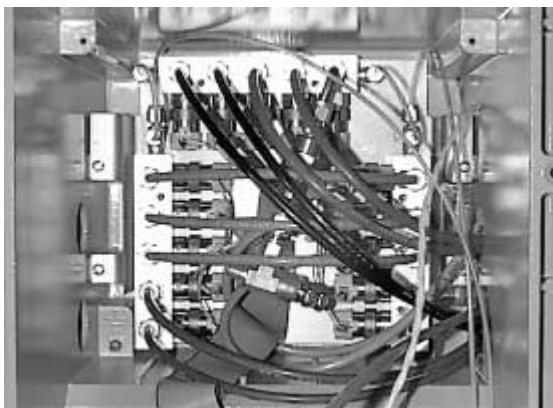


Figure 3-12 TCU Manifold

#### TCU Manifold Connections

There are 3 manifolds inside the TCU designated as manifold 'A', 'B' and 'C'. The solenoid valve positions are designated as A1 thru A5, B1 thru B5, and C1 thru C5. Each pneumatic tube is designated by color, matching the lines of the Probe assembly and are each connected to a specific solenoid valve.

The recommended connecting sequence, within the TCU, is to start with the reference line of each tank and continue as listed in Table 3-2.

Table 3-2 Tubing Connection Sequence

SEQ.	LINE	COLOR
1	Reference ('R')	Brown or Blue
2	Narrow ('N')	Red
3	Wide ('W')	Orange or Gray
4	Water ('H')	Black
5	Tank Top ('T')	Yellow

#### NOTE

On configurations which have water measurement available, if selected without water measurement, disregard the 'H' tubing lines and corresponding solenoid valves. For short tanks, disregard 'W'.

Refer to the appropriate configuration diagram in Figure 3-14 or connection label on the inside of the TCU door (refer to Figure 3-13).

#### Tubing Preparation/Installation into TCU Fittings

Trim the tubing leaving enough length to allow tubing to be inserted straight into fitting avoiding strain and providing a 1-inch minimum bend radius. Install inserts into tube end, then fully insert the tubing into the designated manifold fittings, and tighten nuts

1-1/2 turns from finger tight. Repeat this procedure for the remaining lines to be installed, per the sequence listed in Table 3-2.

The nitrogen supply line connects to the in-line filter/pressure relief valve assembly (see Figure 3-14).

Trim the tubing inside the TCU install insert into tube end, then fully insert into the in-line filter. Allow enough tube length to avoid strain at the fitting with a 1-inch minimum bend radius. Tighten the fitting nut 1-1/2 turns from finger tight.

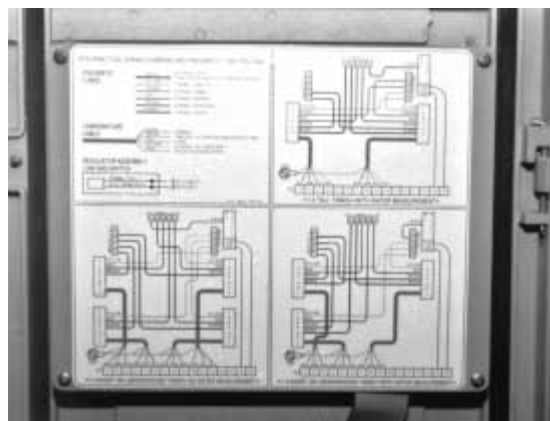


Figure 3-13 Manifold Connection Label (back of enclosure door)

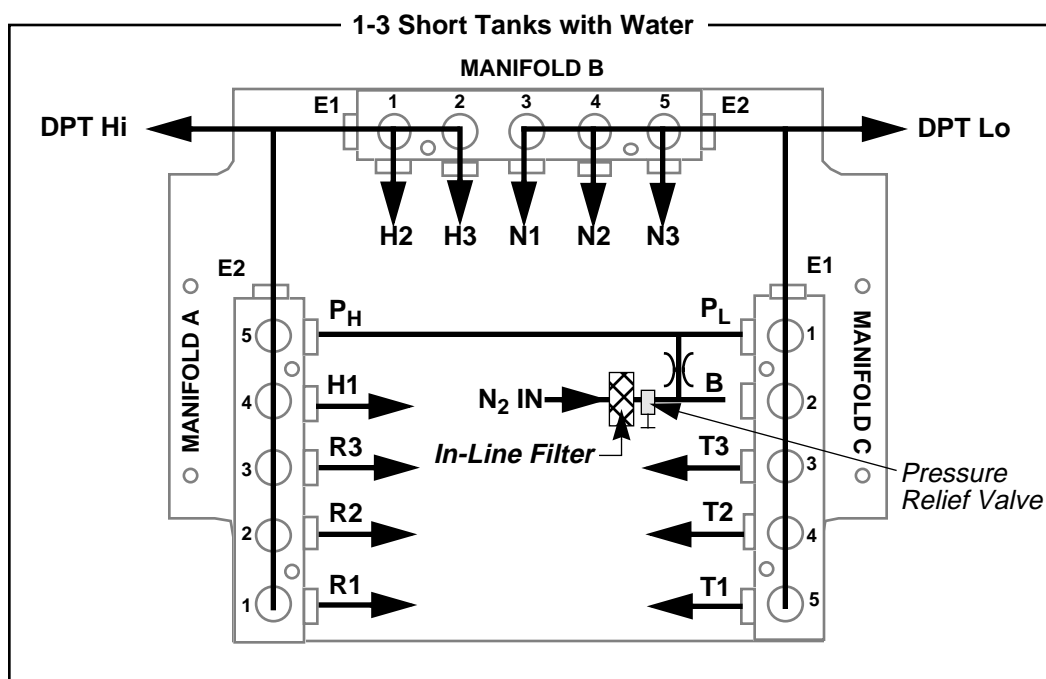
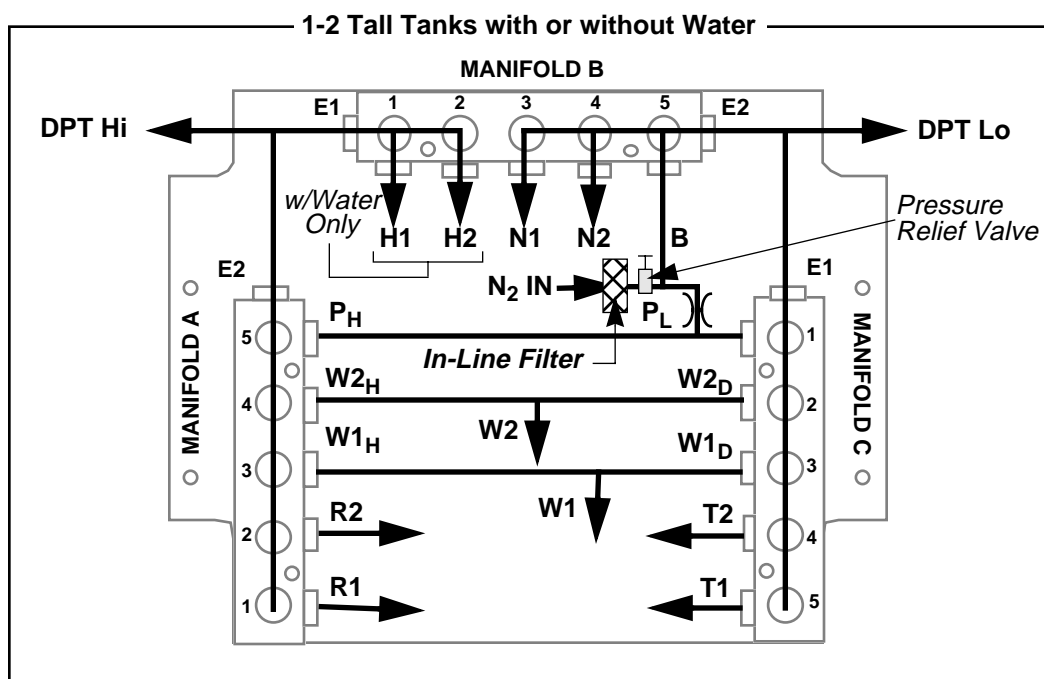
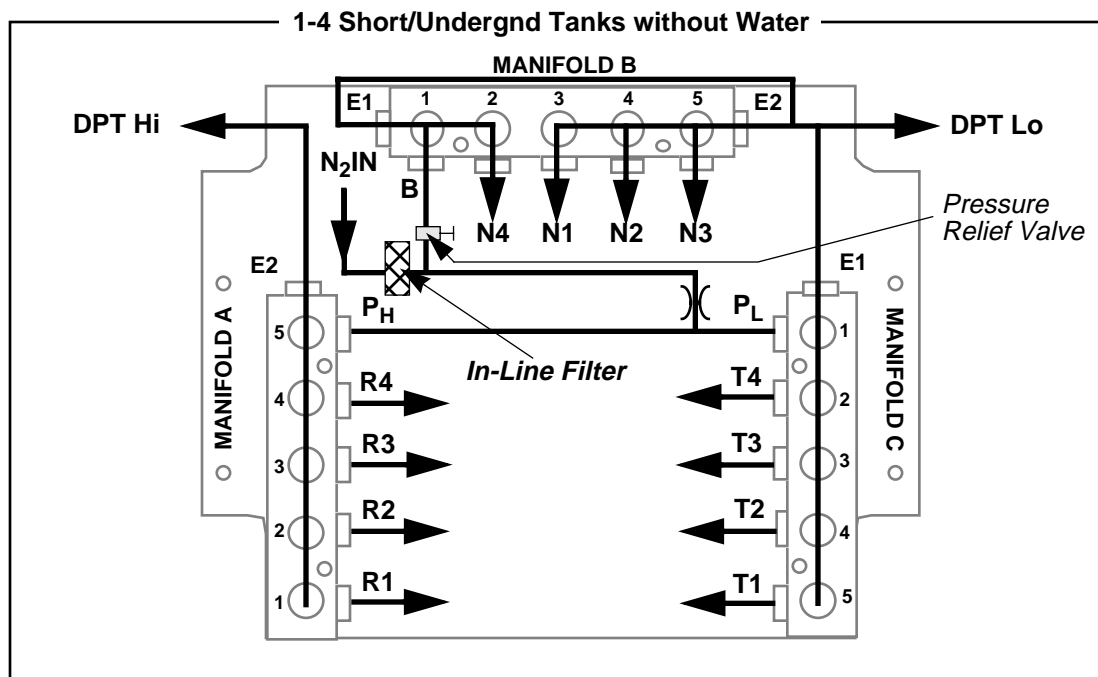


Figure 3-14 TCU Manifold Configurations



**Figure 3-14 TCU Manifold Configurations (Cont.)**

### Leak Check

A leak check of each line should be performed before making the union connections within the tank top box to the tank probe assembly.

#### NOTE

Release pressure in lines prior to replacing or repairing leaking lines.

Close the nitrogen supply valve, then disconnect the nitrogen supply line inside the TCU. Select one line to the tank and connect it to the supply line using a union fitting. Inside the tank top box, connect the selected line to one of the other lines using one of the union fittings provided. At the TCU, open the nitrogen cylinder shut-off valve (1/4-turn).

The output supply pressure gauge will indicate approximately 25 psi. Allow a few minutes for the line pressure to stabilize (15 minutes), then close the cylinder shut-off valve.

The regulator output pressure gauge should not drop more than one (1) psi. If a dropping pressure is indicated, use a leak detect solution on the tube fitting connections to locate the leak. If the

suspected leak is within the conduit, seal off the Tank Top Junction Box end and test single line.

Tighten the fitting(s) or replace the damaged tubing line(s), as required. Repeat leak check after repairs have been completed.

An alternate leak check procedure can be performed if the TCU electrical connections have been completed and the units power is on (See Section 7 - Troubleshooting for details).

### Tubing Preparation/Installation into Tank Top Junction Box Fittings

Once satisfactory results are achieved, slowly release the pressure by loosening the interconnecting union fitting in the tanktop box. Make the necessary union connections in the tanktop box to the tank probe sensing lines, following the color code and provide service loops of 5-6 inch diameters. Tighten fitting nuts 1-1/2 turns past finger tight. Reconnect the supply line and selected tank lines within the TCU to their respective fittings.

### 3-3.5 **Electrical Connections**

Wiring connections for the TCU/TDU, power supply, Tank Top Junction Box, temperature sensors, network communication-TCU/TDU, network barrier are contained in I.S. Installation Diagram, drawing number **TS10-10513** (see Figures 3-15 through 3-20).

This document contains wiring information for the Series 3500 for use in hazardous areas. All notes and procedures must be complied with for the system to be intrinsically-safe.

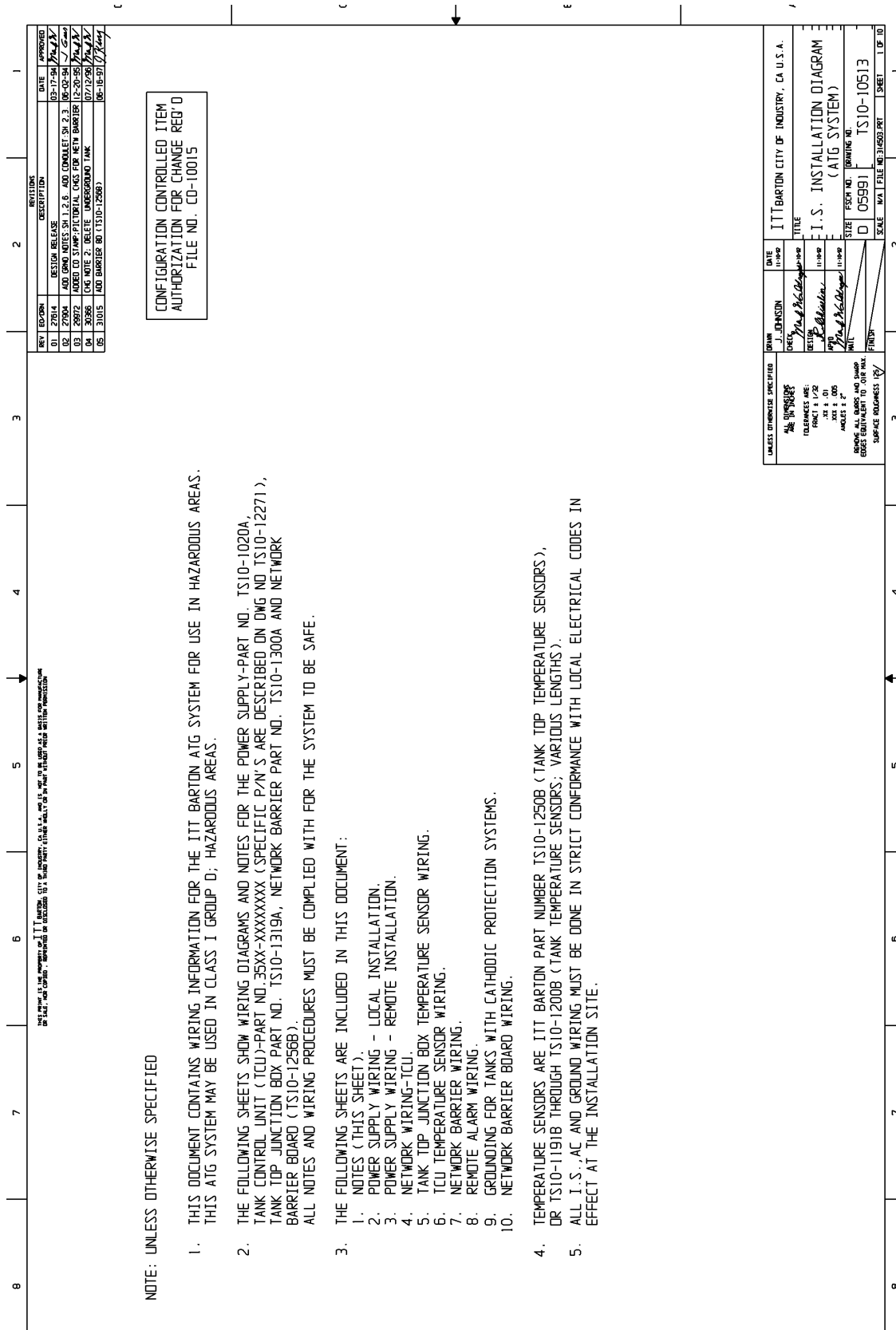
#### **WARNING**

**EXPLOSION HAZARD. FAILURE TO WIRE SYSTEM CONNECTIONS PER BARTON DRAWING NO. TS10-10513 CAN RESULT IN AN EXPLOSION. READ ALL CONNECTION INSTRUCTIONS IN THIS MANUAL AND ON REF. DRAWINGS BEFORE INSTALLING THE TCU.**

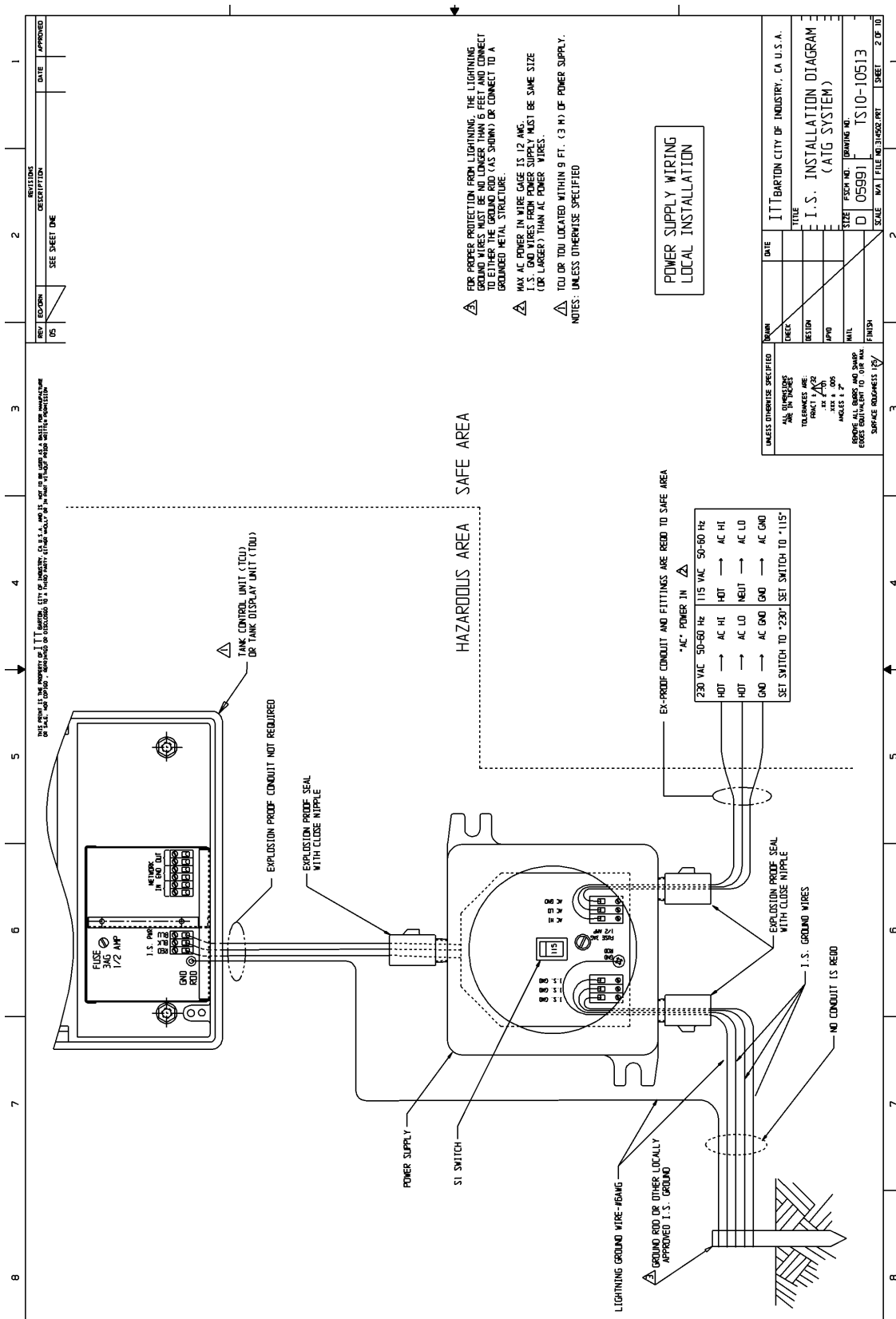
### 3-4 **POWER ON PROCEDURE**

After all physical installation steps are complete, power on the TCU, per the following:

1. Set DIP Switches #2 and #4 to ON (UP position). See Figure 1-4 for DIP Sw. location.
2. Turn ON main power to TCU Power Supply.
3. "Enter Unit Number" message is displayed on the TCU LCD to confirm the TCU is active.
4. Enter TCU Unit Number (ref. para. 5-5.1), then Press the ENTER key twice (2X) to accept.
5. Set DIP Switch #2 to OFF (DOWN position).







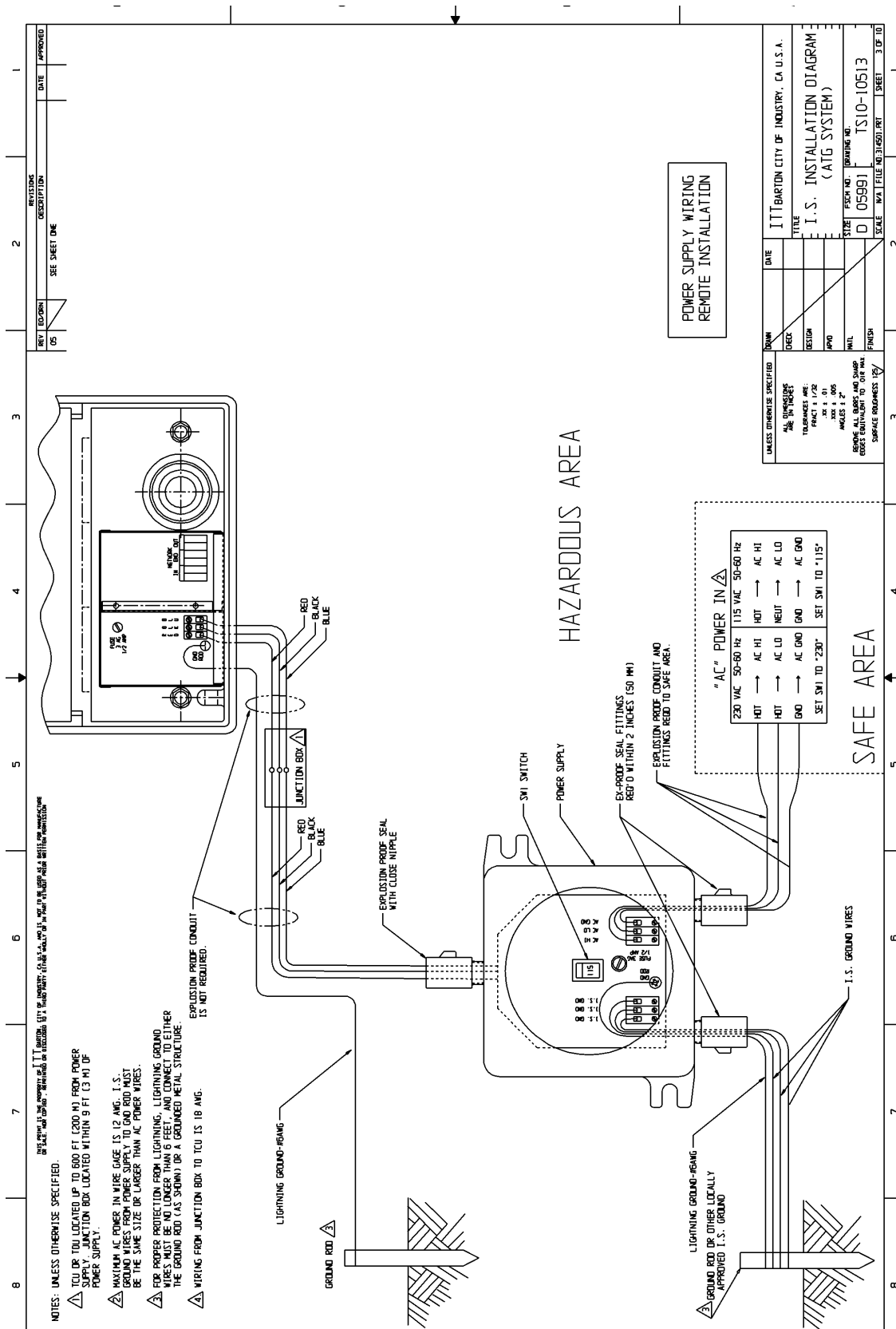


Figure 3-17 Wiring Drawing TS10-10513 (3/10)



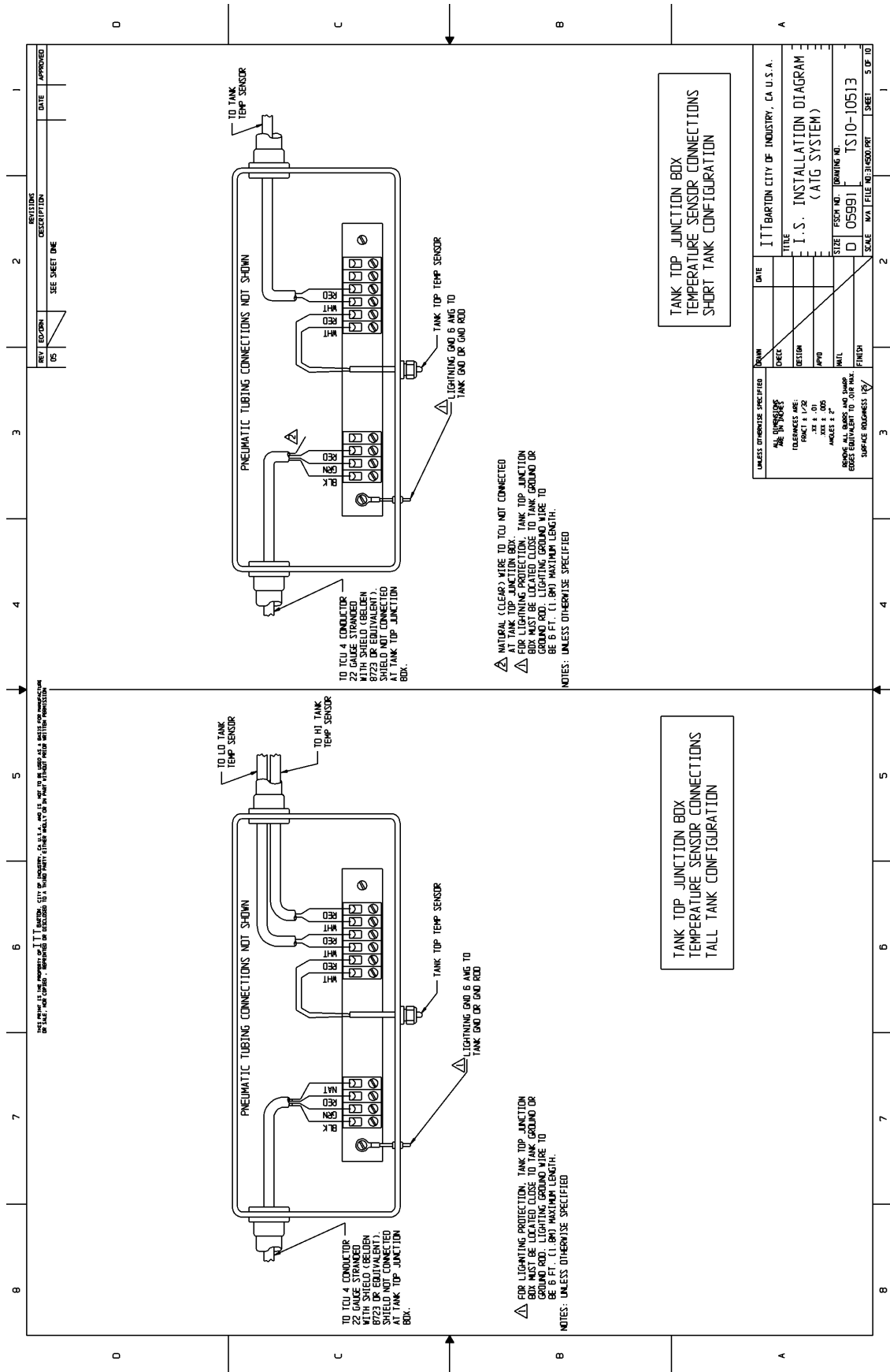


Figure 3-19 Wiring Drawing TS10-10513 (5/10)

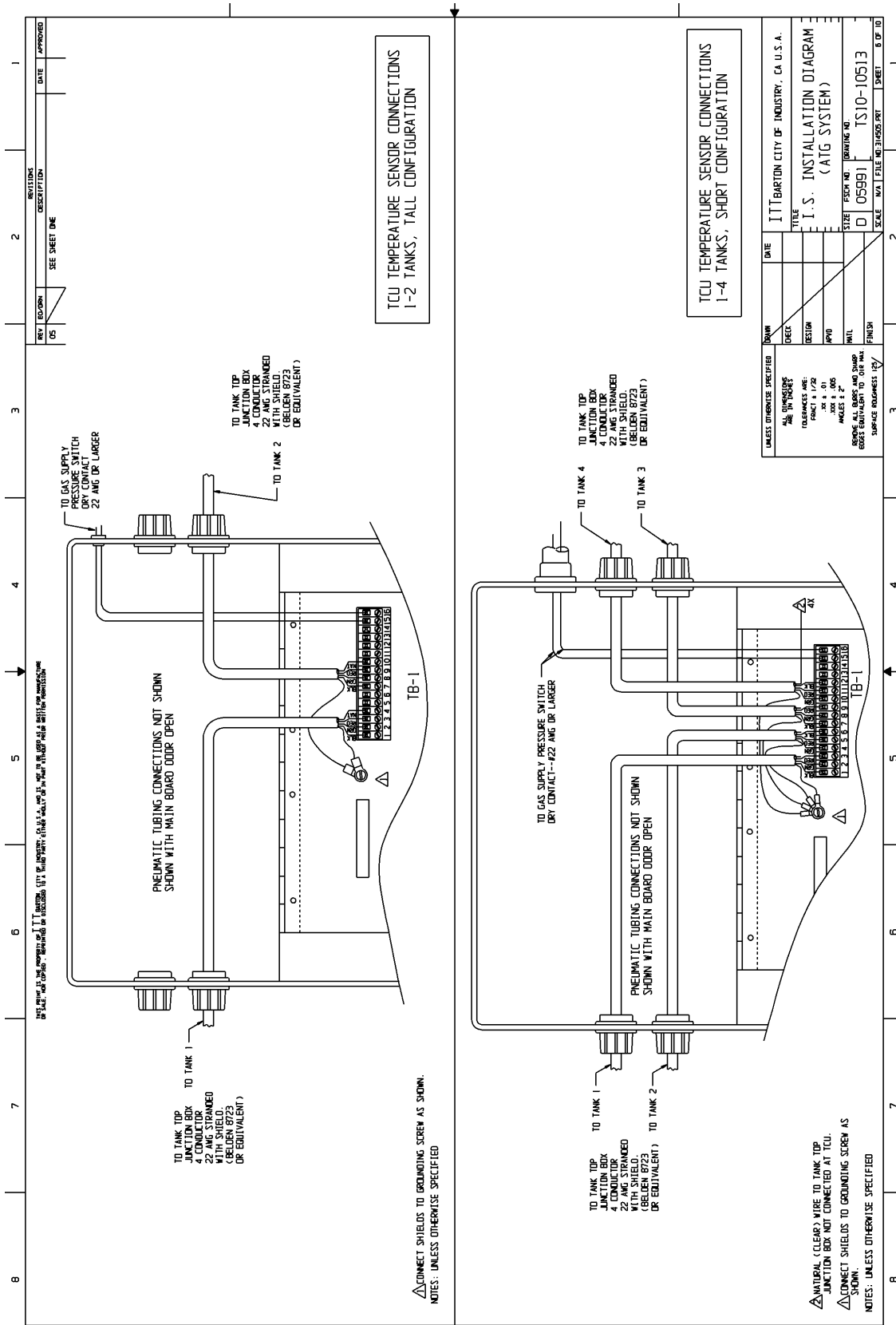


Figure 3-20 Wiring Drawing TS10-10513 (6/10)



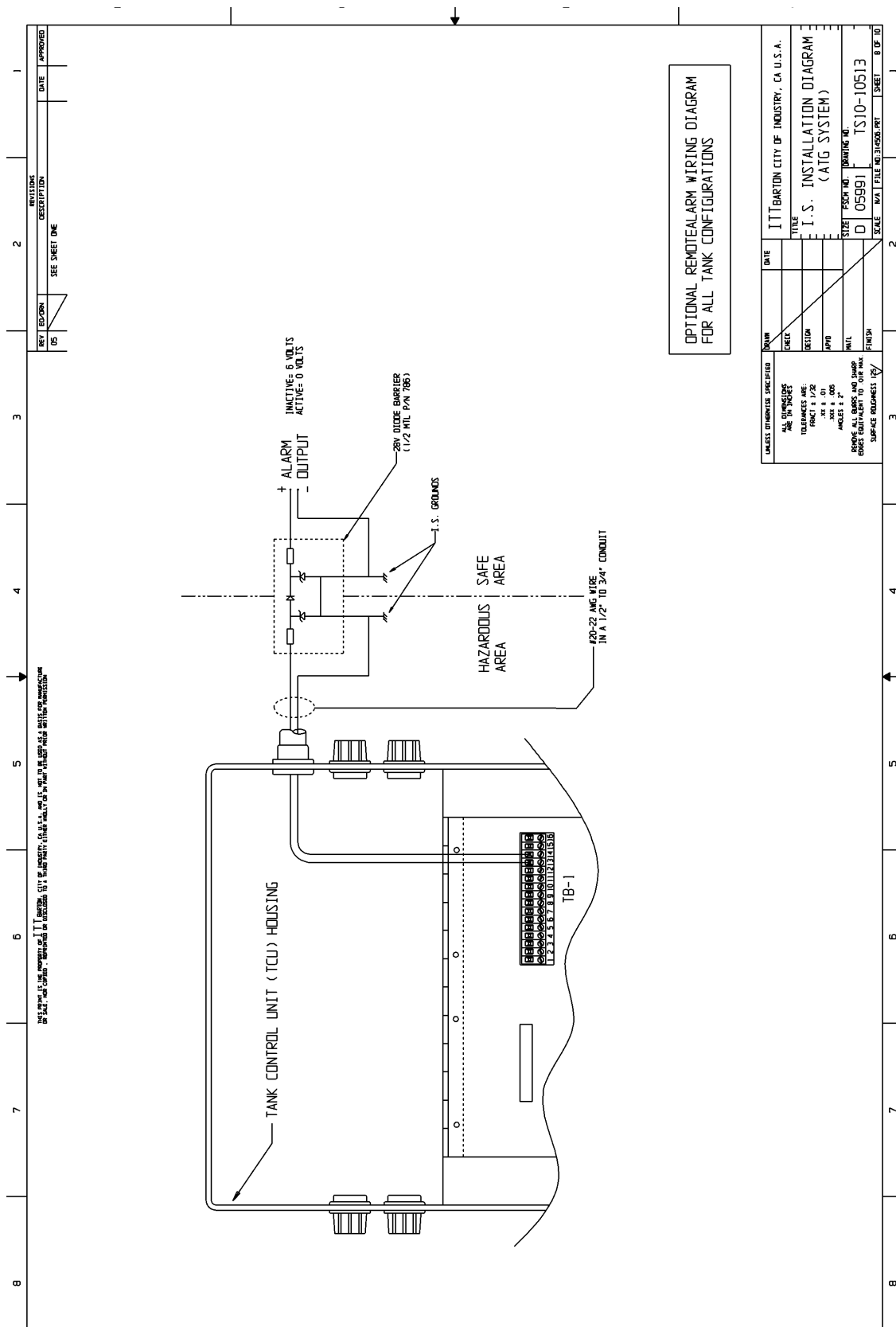


Figure 3-22 Wiring Drawing TS10-10513 (8/10)







## SECTION 4

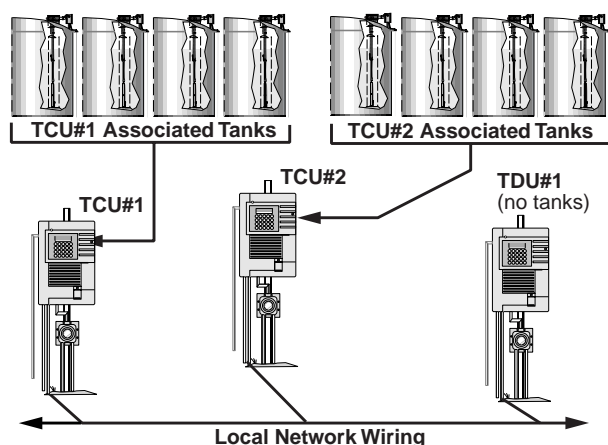
### BASIC TCU OPERATION

#### 4-1 GENERAL

This section describes the basic Series 3500 system, TCU controls and indicators, basic TCU operating system, and an overview of procedure tables used in this manual.

#### 4-2 OVERVIEW

As illustrated in Figure 4-1, the typical Series 3500 installation consists of a group of TCUs (Tank Control Units) and TDUs (Tank Display Units) linked together on a local network. Any unit on the network can be accessed by any other unit on the network for remote viewing and routine operational control.

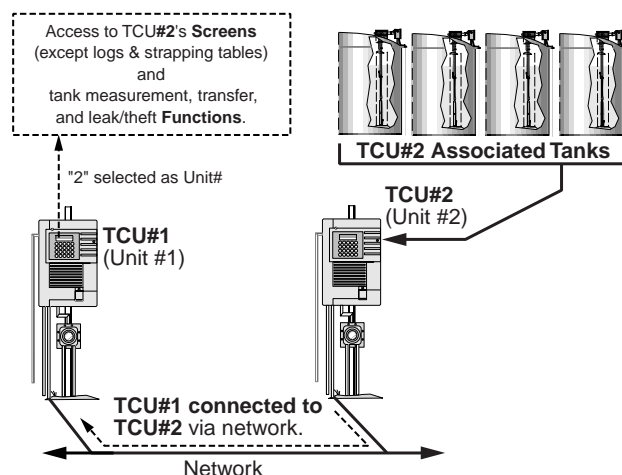


**Figure 4-1 Local Network (Linking TCU/TDUs)**

Each TCU/TDU 'Unit' is assigned a unique Unit Number that represents the unit on the network. When a TCU is "superbooted," a message is displayed on the TCU screen asking the user for a Unit Number.

Each TCU has up to (4) associated tanks. Each tank contains a Tank Probe (hydrostatic pressure and temperature sensing assembly). TDUs do not have associated tanks, they are for remote only.

Tanks are assigned Tank Numbers (1, 2, 3, or 4), in order of installation. Tank numbers only go up to (4), since tanks are assigned to a specific TCU (Unit#). Any TCU can access any other TCU on the same network by changing the local TCU's unit number to that of the desired remote TCU.



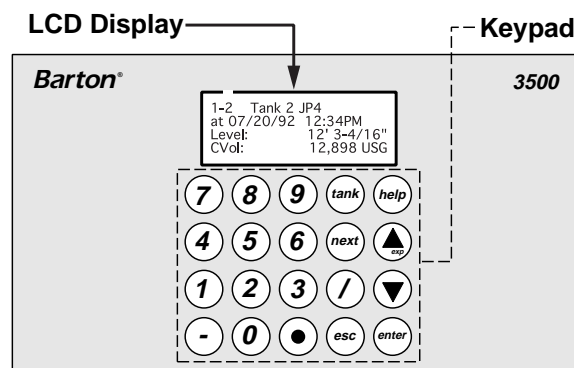
**Figure 4-2 Remote TCU Control**

Once a remote unit number is selected, the local unit effectively becomes the selected unit. All of the remote unit's settings, parameters, and measurement information are accessible for viewing, except for logs and strapping table information.

All operations are performed using the unit's display screen and keypad. The unit's operating system consists of a series of screen PAGES that contain menus, function selections, data, settings, and messages (e.g., alarms).

#### 4-3 DISPLAY AND KEYPAD

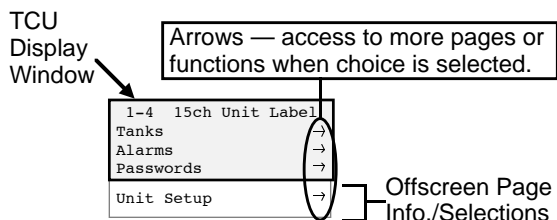
Operation of the Series 3500 is controlled through the use of the TCU's Keypad and LCD Display (window), located on the front cover of the enclosure, as shown in Figure 4-3.



**Figure 4-3 TCU Front Panel**

### 4-3.1 Display

The LCD Display (screen) shows 4 lines of information at a time. If more lines are available for the page being viewed, the offscreen lines can be scrolled up or down into view.

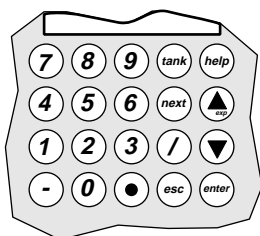


**Figure 4-4 TCU Display Window**

Each menu selection (denoted by a small arrow at right) provides access to lower level pages or other system functions.

### 4-3.2 Keypad

The Series 3500 Keypad, shown in Figure 4-5, consists of 20 keys that are used to control and configure the TCU. A brief description of each key function is given in Table 4-1.



**Figure 4-5 Keypad**

**Table 4-1 Keypad Functions**

KEY(s)	FUNCTION(s)
Numbers [0-9]	Data Entry
“-”, “.”, and “/”	Data Entry
[tank]	Unit/Tank Selection
[next]	Cursor Movement
Escape [esc]	Previous Page
[help]	Access Help Pages
Up/Down Arrows & exp.	Cursor Movement, Letter Character, Exponent Entry
Enter [enter]	Next Page; Accept Entry

## 4-4 OPERATING SYSTEM

### 4-4.1 Overview

The TCU’s operating system consists of a series of menu and data PAGES that are arranged in levels, as shown in Figure 4-6 on page 4-3. A complete menu/data page flow chart is provided at the end of this section, see Figure 4-21.

All system functions, user parameters, variables, measurement readings, configuration settings, and diagnostics are accessed by menu page selection.

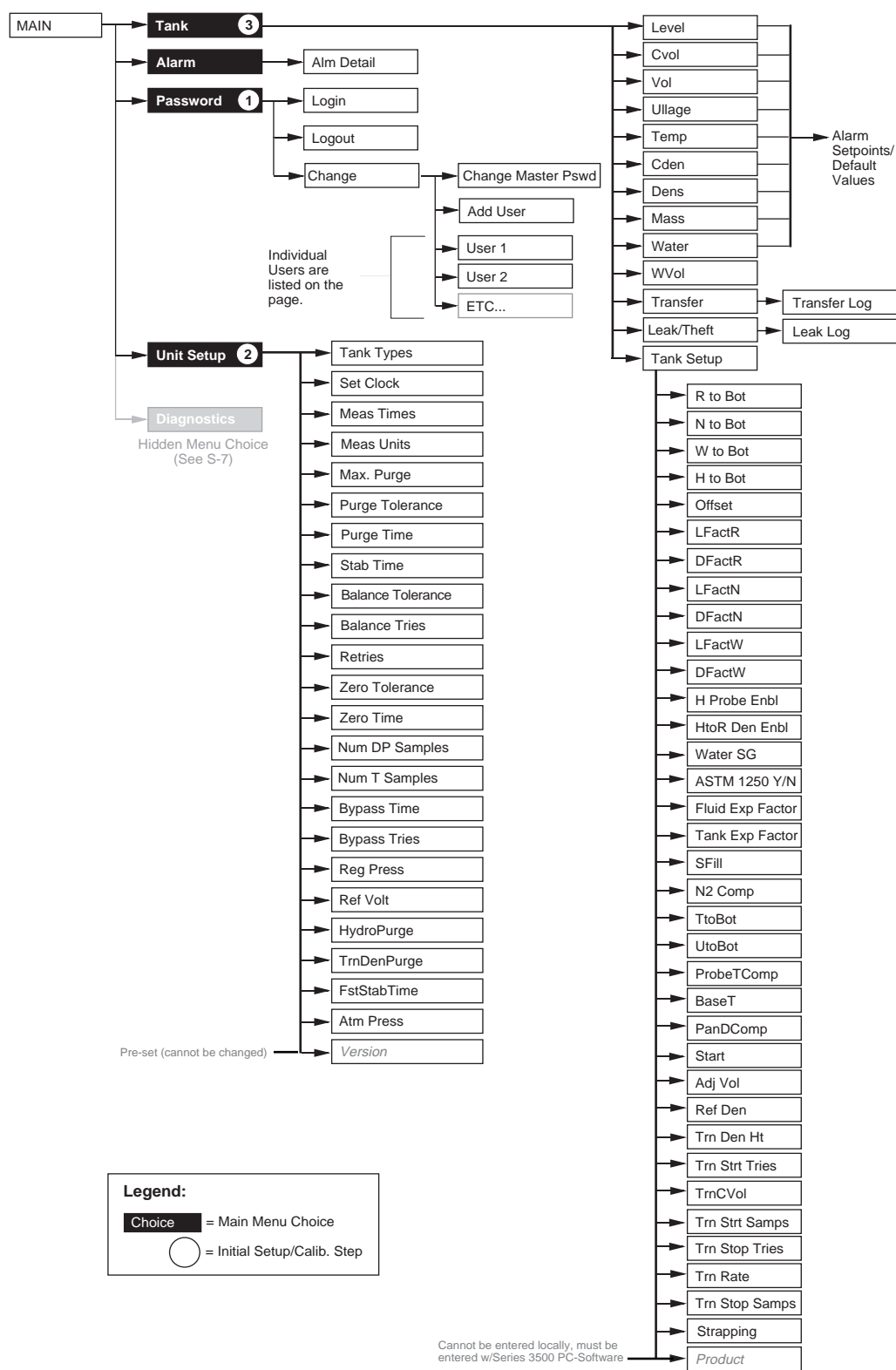


Figure 4-6 TCU Operating System Page Overview

#### 4-4.2 Primary Page Functions

The primary local TCU display page functions are listed in Table 4-2. During SETUP, all pages will be accessed. For NORMAL operations, the user accesses the Main Menu, Password, Tank, and Alarms Page (if an alarm cursor is present).

If troubleshooting/maintenance is required, the Diagnostics Page may be used to check solenoid valve operation — see Section 7.

**Table 4-2 Primary Page Functions**

PAGE	OPERATIONS
MAIN MENU	Select Unit # Enter Unit Label Access Other Pages
PASSWORD	Login Logout  (Master Password Required) Enter/Delete Users Change User Passwords Change Master Password
TANK	Select Unit# and Tank# Enter/Change Tank Label View Measurement Data Take Tank Measurement Access Transfer Page (Transfer Log) Access Leak/Theft Page (Leak/Theft Log) Access Tank Setup Page (Strapping Table) View Product Label *
ALARMS	Select Unit# View Alarms Acknowledge Alarms (must be logged-in)

**Table 4-2 Primary Page Functions (Cont.)**

PAGE	OPERATIONS
UNIT SETUP	Enter Tank Types Set TCU System Clock Enter Measurement Times Enter Measurement Units Enter Max. Purge Enter Purge Tolerance Enter Purge Time Enter Stabilization Time Enter Balance Tolerance Enter Balance Tries Enter Retries Enter Zero Tolerance Enter Zero Time Enter NumDP Samples Enter NumT Samples Enter Bypass Time Enter Bypass Tries Enter Regulator Pressure Enter Ref. Voltage Enter HydroPurge Enter TrnDenPurge Enter FstStabTime Enter Atm Press View Version No.**

\* *Product Label cannot be entered locally. Series 3500 PC-Software must be used to enter Product Label.*

\*\* *Version number is for reference only. It cannot be changed by the user.*

In addition to the above main menu page selections, there is a hidden **Diagnostics Page** accessible through the Main Menu. The Diagnostics Page is used to perform manual diagnostics (local unit operation only) and view solenoid valve operation during automatic measurements. **Details on Diagnostics Page access and use are given in Section 7** — Troubleshooting and Maintenance.

#### NOTE

Manual diagnostics operation is not accessible from a remote TCU. Manual diagnostics functions must be performed at the local TCU site.

### 4-4.3 Main Menu

The MAIN MENU page, shown in Figure 4-7, is the starting point or top level. All other pages are accessed from the Main Menu page.

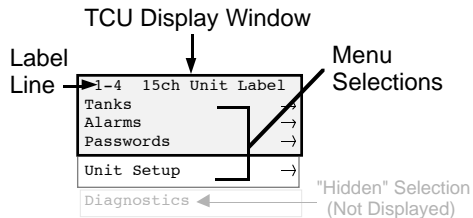


Figure 4-7 Main Menu Page

The Main Menu page contains a Unit Label Line and (6) menu selection lines. The Unit Label Line consists of the Unit Number and a 15 character Unit Label. The Unit Number represents a particular TCU on the network. The Unit Label is a user entered name for the unit number selected.

### 4-4.4 Operational Modes

The Series 3500 system has two basic operational modes: (1) locked and (2) unlocked (requires a password) and an independent alarm mode that functions whether the system is locked or unlocked. The system mode is indicated by the display cursor's format.

#### 4-4.4.1 Normal Display Cursor

The Series 3500's normal display cursor is a flashing box - flashing between the current character being displayed and the box cursor.

#### 4-4.4.2 Unlocked System Cursor

When the system is unlocked, the cursor flashes alternately between the standard cursor and a lower case "u" (unlocked).

#### 4-4.4.3 Alarm Cursor

If an alarm condition exists anywhere on the network, the cursor on all network TCUs and TDUs will flash alternately between the current cursor format and the "A<sub>L</sub>" (alarm) cursor. The appearance of this cursor will remain until the alarm(s) are acknowledged through the Alarm Page.

#### 4-4.4.4 Data Entry Cursor

When entering data, the cursor becomes a LARGER flashing box. Once data entry is complete, the cursor returns to its standard format.

### 4-4.5 Password Operation

#### 4-4.5.1 Login/Logout (Local TCU only)

When the system is locked, a user can view all display pages; however, no settings or variables can be changed and alarms cannot be acknowledged.

In order to make changes or acknowledge alarms, the user must LOGIN, by entering a User Name and Password. The system comes configured with the following pre-set users:

**Operator — Level 1** (Read Only and Alarm Acknowledgement):

Name = 1

Password = 1

**Maintenance — Level 2** (Read, Write, and Alarm Acknowledgement):

Name = 2

Password = A2

Once unlocked, the user has access per the level of the Name/Password entered at login. A separate Master Password is required to add, delete, or change user passwords, even if the system is unlocked.

#### NOTE

The Master Password cannot be used to LOGIN, a User Name and Password must be entered.

Upon completing the required tasks, the user should LOGOUT (locking the TCU). This prevents open access to the Series 3500 system.

#### NOTE

When the TCU has been idle (no keys pressed) for 5 minutes, the system automatically logs-out the user and returns the display to the Main Menu Page.

#### 4-4.5.2 User Setup (Master Password)

The system comes configured with a default Master Password of “POL1” that provides open access to the Change Passwords Page. During initial setup, users and their passwords are entered (up to 10 users). User names and passwords can be any combination of letters, numbers, and punctuation (up to 10 characters long). Once a user/password list has been entered, the default users can be deleted for security.

User setup can be done on a locked or unlocked TCU. If the TCU was locked prior to inputting the Master Password, the system will be locked when the user leaves the Password Page.

### 4-5 UNIT AND TANK SELECTION

#### 4-5.1 Overview

To view data for or make setting changes to a local TCU, the local TCU’s Unit Number is selected. To view screens, or Tank, the desired TCU unit and Tank must be selected. Selection of a particular TCU Unit can be done from the **Main Menu Page** and **Tank Page**. The cursor is placed at the beginning of the Unit Label line (1st line of the display) and the desired TCU Unit number is selected by scrolling through a list of network units.

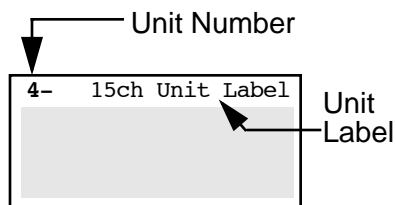


Figure 4-8 TCU Unit Number/Label

Tank selection can be done only from the **Tank Page**. The cursor is moved to the top line, then moved to the tank number position, then the desired Tank number is selected by scrolling through a list of tanks connected to the currently displayed TCU.

#### 4-5.2 Network Access

##### Unit Selection

To access a remote TCU, the local unit must be “locked” — no user logged in. If a user is logged

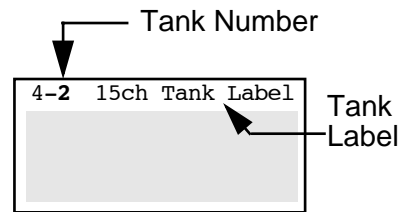


Figure 4-9 Tank Number/Label

in to a local unit and attempts to change the Unit Number to a remote TCU, a “Logout Required” message appears.

If the user is currently viewing a remote TCU (Unit No. set to a remote TCU’s unit number), login is not possible — the Login line of the Password Page changes to “Not Local Unit.”

##### Tank Selection

All tanks on the network are TCU specific, to access a specific tank, the Unit being operated must be set to the TCU Unit number associated with the desired tank(s). Remote access to tanks is restricted to viewing only.

### 4-6 CONTROL OPERATIONS

#### 4-6.1 Moving the Cursor

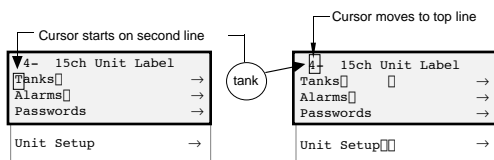
Basic cursor operations include: moving the cursor to the top line to select a unit number/tank number and/or label, moving the cursor up or down (line to line) to make menu choice selections, and moving the cursor character by character during data entry.

##### 4-6.1.1 Moving Cursor to Top Line

In order to select a Unit or Tank Number, or enter/change a Unit/Tank Label, the cursor must be moved to the top line.

As shown in Figure 4-10, when the Main Menu is first selected, the cursor begins on the second line. When viewing the Main Menu, Alarms, or Tank Page, the cursor can be moved to the top line by pressing the **[tank] key**. When the cursor is first moved to the top line, it starts at the Unit Number character position (upper left corner). The original cursor position does not matter.

If the cursor fails to move to the top line (w/ [tank] key), it indicates that access to the top line is not available from the currently displayed page.



**Figure 4-10 Moving Cursor to Top Line**

Once the cursor is on the top line (at Unit Number position, pressing the **[next]** key moves the cursor to the Tank# (if on Tank Page) or to the Unit Label (if on Main Menu Page) position. If the Tank Page is currently displayed and the cursor is at the Tank# position, pressing the **[next]** key will move the cursor to the Tank Label position.

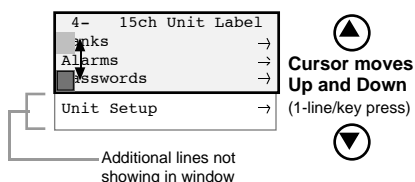
The **[esc]** key can be pressed at any time to cancel the operation and return the cursor to its original position. The Unit#, Tank#, and/or Label will return to its previous setting.

#### 4-6.1.2 Moving Cursor Line by Line

The arrow keys are used to move the cursor from line to line. Each press of an arrow key moves the cursor up or down (1) line.

#### 4-6.1.3 Scrolling Display Lines

Since the display only shows (4) lines at a time, to see other page lines, the display is scrolled, as shown in Figure 4-11 and Figure 4-13.



**Figure 4-11 Cursor Movement**

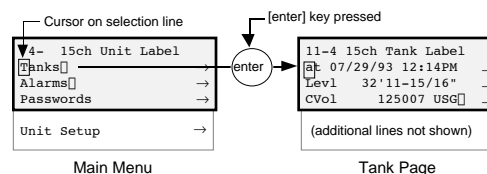
When the cursor reaches the last line displayed, pressing the down arrow key will cause the cursor to move to the next line – scrolling the lines up – bringing the next line into view.

With the cursor on a line below the top four lines, the display lines scroll in the opposite direction when the cursor is moved up and past the second line currently displayed.

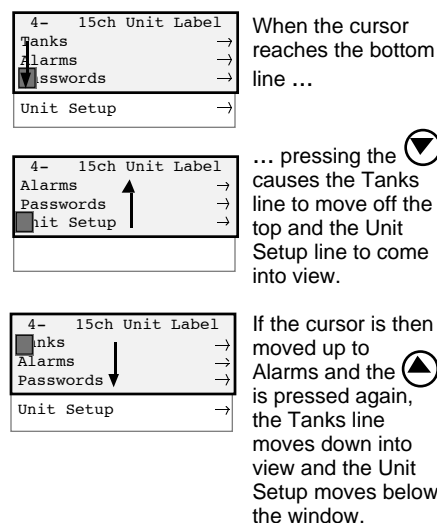
#### 4-6.2 Selecting Menu Choices

To select a menu choice, the cursor is moved to the desired line and the **[enter]** key is pressed.

The display changes to the selection's page, as shown in Figure 4-12.



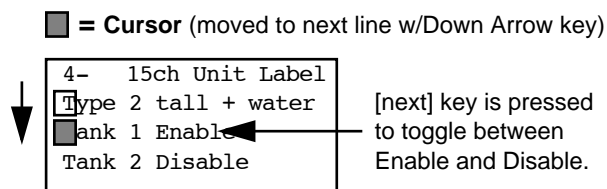
**Figure 4-12 Menu Selection**



**Figure 4-13 Scrolling**

#### 4-6.3 Making Choice Selections

When the display gives a choice of settings rather than requiring an entry, the **[next]** key is used to toggle between the possible options. For example, during setup, the Tank Types Page is displayed, as shown in Figure 4-14



**Figure 4-14 Choice Selections**

If the system has (1) tank, then Tank 1 would be set to Enable and Tank 2 to Disable. If the system had (2) tanks, both items would be set to Enable. The selection is made by placing the cursor on the line item to be changed **[arrow key]**, then the **[next]** key is pressed to toggle the choice (Enable or Disable). When the item is set correctly, the **[enter]** key is pressed to accept the choice.



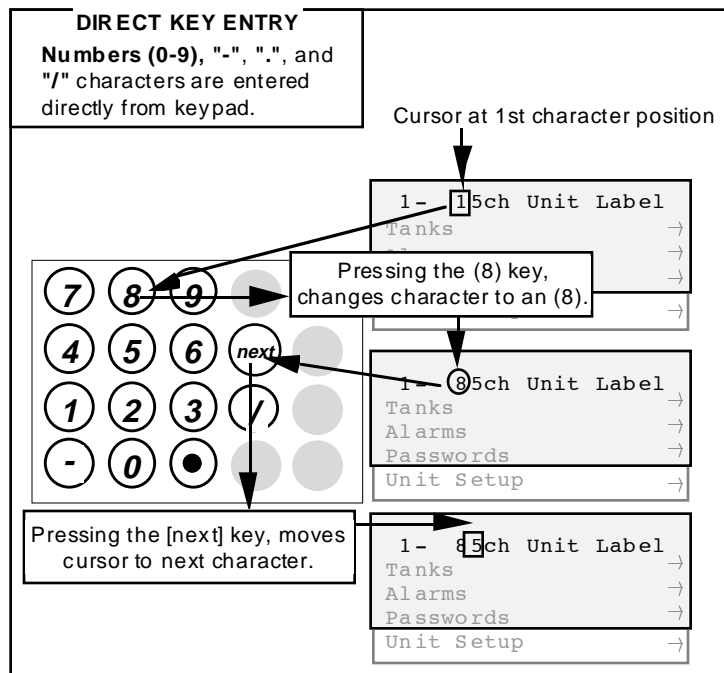


Figure 4-15 Direct Key Entry (Numbers/Key Characters)

#### 4-6.4 Entering Labels, User Names, and Passwords

Entry of Labels, User Names, and Passwords involves two methods depending upon whether the character to be entered is a number or letter/punctuation character. These two methods can be used in conjunction, since labels, names, and passwords can be any combination of numbers, letters, and punctuation characters.

The ".", "/", "-", and **number keys** are used to enter those characters directly (see Figure 4-15). The desired character is entered by pressing the appropriate key, then moving the cursor to the next character position by pressing the **[next]** key.

The up and down arrow keys scroll through a list of **upper and lowercase alphabet and punctuation characters** (see Figure 4-16). Using this method requires selecting the desired letter/character from a list, then manually moving the cursor to the next character position with the **[next]** key.

This process is repeated until all desired characters are entered.

#### 4-6.5 Entering Data

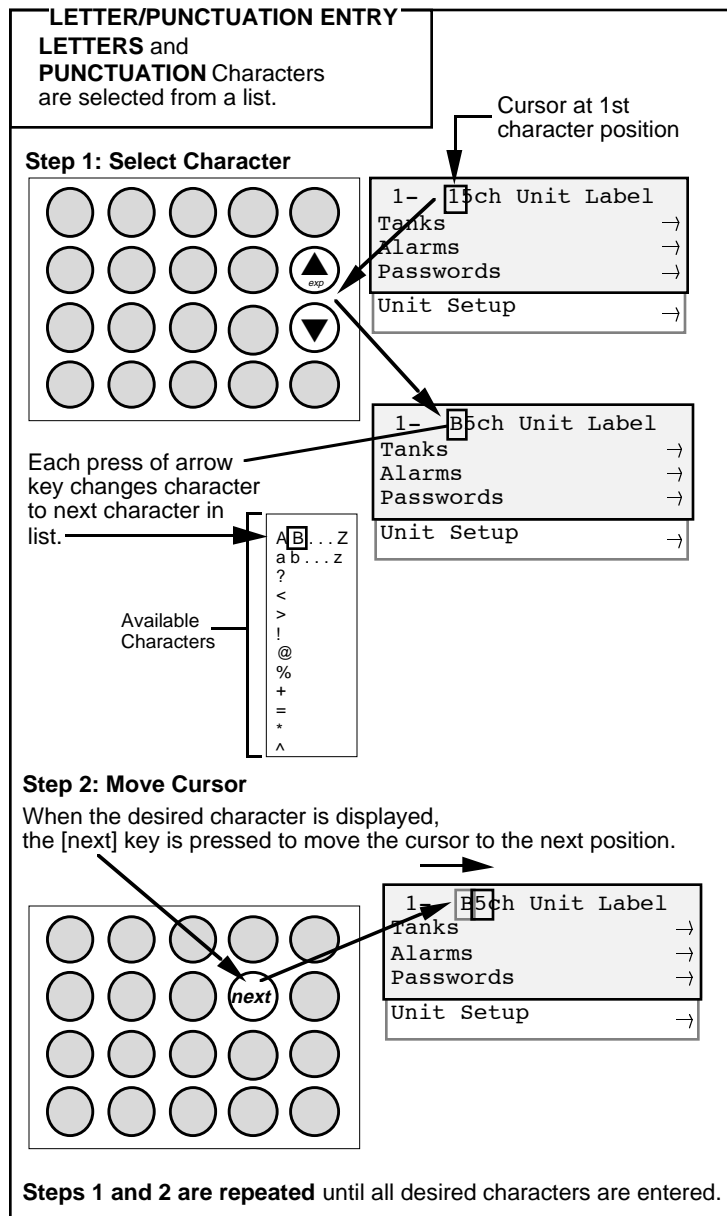
The **number**, ".", "-", and **"exp" keys** are used to enter numerical data. Numerical data includes variables, probe measurements, and other setup values.

Except where noted, data entry is done as a single cell of numbers, not character by character (e.g., labels). Once a data line is selected, all numbers (including decimal point) are entered one after the other, the system automatically moves the cursor to the next character position when a key is pressed.

#### NOTICE

If a value already exists, it will be blanked from the screen as soon as a new entry is started. However, until the [enter] key is pressed, the [esc] key can be used to cancel the entry and return to the original value.

When the new data entry is complete, the **[enter]** key is pressed to accept the new data. The cursor will return to the start of the line.



**Figure 4-16 Entering Letters/Punctuation**

#### **4-6.6 Returning to Previous Page**

The **[esc]** key can be used to return the display to the previous page. For example, if the display is currently showing the TANK page, pressing the **[esc]** key will return the display to the MAIN MENU page (the next level up).

#### **4-6.7 Cancel Entry**

The **[esc]** key can also be used to cancel an entry any time before the **[enter]** key is pressed. When an entry is cancelled, the cursor returns to its position prior to starting the procedure and the data, label, parameter, or setting returns to its previous value.

## 4-7 TCU PROCEDURES

### 4-7.1 Overview

Sections 5, 6, and 7 contain setup and operation procedures. These procedures are presented in the form of tables for easier reference. In addition, supporting information, details, and notices are provided to supplement the procedure tables.

An example procedure table is shown in Figure 4-17. There are (4) columns of information in the table:

1. Step Number
2. Action
3. Result
4. Notes

Specific actions (e.g., pressing a keypad button) are shown in **BOLD** type. In most cases, if the

results of the action affects the page display, an illustration of the TCU display screen is shown. If there is any additional information the user should have at that particular step of the procedure, it is presented under the Notes column.

The column format provides a logical sequence of required actions, while providing additional information as needed. This makes initial setup and operation easy for even new users.

In addition, the format provides benefits for experienced users — quick reference. An experienced user can simply go from action to action step without having to search through text for which key to press.

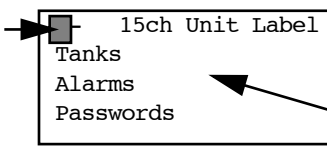
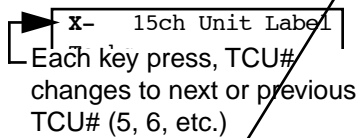
STEP	ACTION	RESULT	NOTES
1	Move cursor to TCU#: <b>Press TANK key</b> <b>Proper sequence is provided by numbered steps.</b>		If TANK key is pressed again, TCU # displayed becomes TCU # of unit. <b>Results shown (display examples) or listed, as needed.</b>
2	Select TCU Unit # to be used. If desired unit # is currently displayed, GO TO STEP 4, otherwise continue to step 3.	<b>What will be accomplished by the action.</b>	
3	Display other network TCUs: <b>Press UP or DOWN Arrow keys</b> <b>Specific action to be done. (in BOLD)</b>		<b>Supplemental information or data.</b>
4	Select TCU# currently displayed: <b>Press</b> <b>Indicates table continues on next page.</b>	Accepts Unit # entry.	Cursor returns to position prior to step 1 of this procedure.

Figure 4-17 Procedure Table Parts

## 4-7.2 Procedure Examples

The following procedure examples explain the use of the procedure tables for Login (e.g. #1) and Unit Selection (e.g. #2).

### 4-7.2.1 Procedure Table Example #1

The procedure table illustrated in Figure 4-18, shows how to ‘login’ on a **local** TCU. The procedure involves moving the cursor, making menu selections, entering a user name, entering a user password, and returning to the main menu.

#### Controls Used:

- Arrow keys — move cursor up or down
- Number keys — data entry
- Arrow + [next] Keys — letter/punctuation entry
- [next] key — move cursor to next character
- [enter] key — menu selection or accept entry
- [esc] key — go to previous screen or cancel entry

The following describes each step in the LOGIN procedure table:

#### STEP 1:

The procedure is started from the Main Menu Page. The cursor is moved to the Passwords line, using the **arrow keys** (each key press moves the cursor one line).

#### STEP 2:

To select Passwords, the **[enter]** key is pressed. The display then changes to the Passwords Page.

#### STEP 3:

The cursor automatically appears on line #2, the Login line, when the passwords page is first selected. If the cursor is on some other line, it can be moved with the arrow keys.

#### STEP 4:

To select Login, the **[enter]** key is pressed. The display then changes to the Login Page.

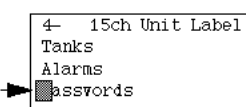
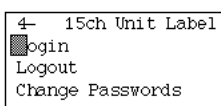
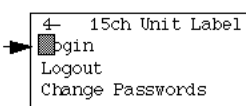
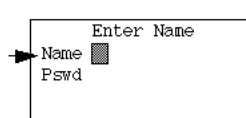

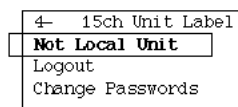
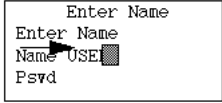
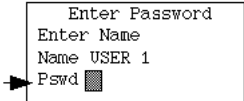

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORD line: (If cursor is on Password line, go to step 2) <b>Press UP or DOWN Arrow key.</b>		<b>Default Users:</b> User 1 (Level 1 Access) Name = 1; Password = 1  User 2 (Level 2 Access) Name = 2; Password = A2.
2	Go to PASSWORD Page: <b>Press [enter] key.</b>		
3	Cursor starts at Login line. <b>If cursor is on Login line, go to step 4...</b>  ...otherwise, Press UP Arrow key to move cursor to Login line.		
4	Go to LOGIN Page: <b>Press [enter] key.</b>		If login page is accessed, go to step 5.
	<b>Error</b>		If Login line changes to "Not Local Unit," the local TCU is currently being used to view a remote TCU (Unit No. set to remote TCU's Unit No.) — <b>Login is not possible.</b>
		If "Not Local Unit" Error Message is displayed and login is desired, go to Unit Selection/Label Procedure (Table 5-6) on page 5-12, change Unit No. to local unit, then repeat the login procedure.	

Figure 4-18 Login Procedure Example

STEP	ACTION	RESULT	NOTES
5	<p>Enter User NAME (1-character at a time):  <b>For Number, (.), (-) and (/) keys</b>, press appropriate key.  <b>Then, press [next] key</b> to move cursor to next character.</p> <hr/> <p><b>Letter/Punctuation — press UP or DOWN Arrow key</b>, until desired character is displayed.  <b>Then, Press [next] key</b> to move cursor to next character.</p>	<p>Selected character changes to number, symbol, or letter entered.</p> 	<p><b>Default Users:</b>  User 1 (Level 1 Access)  Name = 1; Password = 1    User 2 (Level 2 Access)  Name = 2; Password = A2.</p>
Repeat Step 5, until all characters are entered.			
6	<p>When all characters are entered, <b>ACCEPT ENTRY: Press [enter] key.</b></p>		<p>Cursor automatically moves to the password line, ready for entry.</p>
7	<p>Enter PASSWORD (1-character at a time):</p> <p>(See step 5 for specific procedures)</p>	<p>Selected character changes to number, symbol, or letter entered.</p> 	<p>Refer to Section 4 for information on entering data and information.</p>

**Figure 4-18 Login Procedure Example (continued)**

### STEP 5:

In the Login Page, the user name is entered first. The cursor automatically appears in the proper place — no need to move the cursor.

#### Direct Key Entry

The keypad can be used to enter a user name for any number or punctuation character displayed on the keypad. Each character is entered separately. After a number/punctuation key is pressed, the **[next] key** is pressed to move the cursor to the next character position. The procedure is repeated until all desired characters are entered.

#### Letter/Alt-Punctuation Entry

If a letter or punctuation character (other than those on the keypad) are desired, the arrow keys are used to scroll through a list of letters/punctuation characters.

The character at the cursor position changes to the next character in the list with each press of an arrow key. When the desired letter/punctuation is displayed, the **[next] key** is pressed to accept that

character and move the cursor to the next character position. This procedure is repeated until all desired characters are entered.

### STEP 6:

When all the characters of the user name have been entered, the **[enter]** key is pressed. The cursor automatically moves to the Password (Pswd) line.

#### Error

If the user name that was entered is not correct (either a typing error or the name has not been setup with the master password), an error message will be displayed — “Error Not on File.”

The error message will stay on the screen for a few seconds, then the display will return to the Passwords Page. If this occurs, Steps 3 through 6 must be repeated.

### STEP 7:

The password is then entered, using the same methods used for entering the user name.

7	Enter PASSWORD (1-character at a time):  (See step 5 for specific procedures)	Selected character changes to number, symbol, or letter entered.  <div> Enter Password  Enter Name  Name USER1  Pswd 111 </div>	Refer to Section 4 for information on entering data and information.
8	When all password characters are entered, ACCEPT ENTRY: Press [enter] key.	Error:  <div> Error - Not on File  Enter Name  Name USER1  Pswd 11111 </div> ↓ <div> 4- 15ch Unit Label  Login  Logout  Change Passwords </div>	Error message appears for a few seconds, then the display returns to the Password Page.  REPEAT STEPS 3 - 9 w/correct user name and password.
9	To return to the MAIN MENU, Press [esc] key.		

**Figure 4-18 Login Procedure Example (continued)**

#### STEP 8:

When all characters of the Password have been entered, the [enter] key is pressed to accept the entry.

#### Error

As with the user name, if the password is entered incorrectly or is not a valid user password, an error message will appear and the display will return to the Passwords Page.

#### STEP 9:

If the user name and password entered are valid, the display returns to the Passwords Page. Then, the [esc] key is pressed to return to the Main Menu Page.

#### NOTE

The [esc] key is used to change the display to the previous page. It can also be used to cancel an input prior to pressing the [enter] key.

This is the Login procedure from start to finish. Once logged in, the user can (based on access level of user) select a Unit Number, select a Tank Number, enter or change a Label, enter data, change settings, perform system functions (e.g., taking a measurement), etc. on a local TCU.

#### NOTE

A user cannot LOGIN while the local TCU is set to a remote TCU's Unit Number (i.e., viewing remote TCU's screens, taking a remote measurement, etc.).

4-7.2.2 Procedure Table Example #2

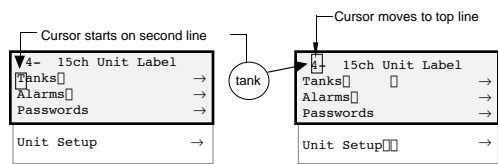


Figure 4-19 TCU Unit Number (Main Menu)

In reference to Figures 4-19/4-20, the following is a detailed explanation of the steps involved in selecting a Unit Number and entering a Unit Label (Table 5-6, Section 5):

**STEP 1:**

Unit selection can be done from either the Main Menu or Tank Page. The table uses the Main Menu as the starting point, since Section 5 is Setup and Verification.

In Step 1, the cursor is moved to the top line by pressing the **[tank] key**. If the **[tank] key** is pressed twice in succession, the local TCU is selected as the active unit — a quick way to determine the unit number of the local unit.

Once the cursor is on the top line, the Unit Number is selected by pressing either the **Up or Down Arrow key** to scroll through a list of available unit numbers. As an arrow key is pressed, the unit number character changes to the next available network unit number.

Once the desired unit number is displayed, the user can either enter a unit label or just accept the unit number selected. Pressing the **[enter] key** accepts the unit number selected and the cursor returns to its position prior to Step 1. If a Unit Label is to be entered, then Step 2 is performed.

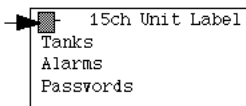
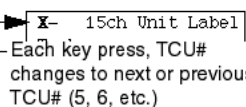
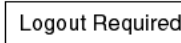
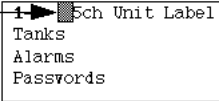
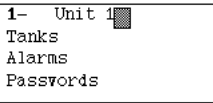
<b>5-9 UNIT SELECTION/LABEL</b>		<b>Unit Label</b>	
This procedure is used to select which TCU/TDU (local or on the network) will be active and to assign the <b>local</b> TCU/TDU unit an alphanumeric label (up to 10 characters).		A Unit Label can only be entered locally or via Series 3500 PC Software, it cannot be entered from another TCU on the network. A user must be logged in (TCU "unlocked") to enter a label.	
<b>Unit Numbers</b>		<b>Network Access</b>	
Whenever a TCU is superbooted, a message is displayed requesting a Unit Number be entered. Once entered, the local TCU can be accessed from any other TCU or host computer on the network by specifying its unit number.		If the TCU being used is locked, the user has view access to any TCU on the network. An <b>"unlocked"</b> TCU (user logged in) <b>cannot</b> be used to <b>access a remote TCU</b> .	
<b>Unit Selection</b>		A TCU cannot be used to change settings, acknowledge alarms, or input stopping table.	
The Unit Number can be entered from the following TCU screen page: <b>Tank Page</b> .		<b>Top of Page</b>	
<b>STEP</b>	<b>ACTION</b>	<b>RESULT</b>	<b>NOTES</b>
<b>1</b>	<b>UNIT SELECTION (From Main Menu or Tank Page)</b>		
a)	Move cursor to the top line: Press <b>[tank] key</b> .		If cursor does not move to top line, Unit # is not accessible from that page.  If the TANK key is pressed twice (2X) in succession, the local TCU being operated becomes the active unit and its current Unit number is displayed.
b)	If desired unit # is currently displayed, go to step (1c).  Select Unit Number: Press <b>UP or DOWN Arrow keys</b> until desired Unit Number is displayed.	 Each key press, TCU# changes to next or previous TCU# (5, 6, etc.)	Only TCUs on the network will be displayed. If the local TCU is "unlocked," the following message screen will be displayed:  <b>LOGOUT</b> (see Table 5-26), then repeat the Unit Selection procedure.
c)	If the desired unit# is currently displayed and <b>no label</b> is to be entered, go to <b>step 3</b> . If a <b>unit label</b> is to be entered, go to <b>step 2</b> .		

Figure 4-20 Unit Number/Label Procedure Table Page Example

STEP	ACTION	RESULT	NOTES
<b>2</b>	<b>ENTER UNIT LABEL (Must be on Main Menu Page)</b>		
<b>a)</b>	With cursor at unit number position, move cursor to Label position: <b>Press [next] key</b>		
<b>b)</b>	Enter TCU UNIT LABEL: (Must be on Main Menu Page, with user logged in)  Enter Label (1-character at a time): <b>For Number, (.), (-) and (/) keys, press appropriate key. Then, press [next] key to move cursor to next character.</b>  <b>Letter/Punctuation — press UP or DOWN Arrow key, until desired character is displayed. Then, Press [next] key to move cursor to next character.</b>		Unit Label can be up to 10 characters long.
<b>c)</b>	<b>Repeat step 2b for each label character to be entered.</b>		
	Once label entry is started, to <b>cancel entry</b> , Press <b>[esc] key</b> to return cursor to position prior to step 1 of this procedure. The Label returns to its original setting.		
<b>3</b>	Accept currently displayed Unit Number and Label: <b>Press [enter] key.</b>	Accepts Unit # entry.	Cursor returns to position prior to step 1 of this procedure.

**Figure 4-20 Unit Number/Label Procedure Table Page Example (continued)**

## STEP 2:

With the cursor at the unit number position, the **[next] key** is pressed to move the cursor to the Unit Label position.

### NOTE

A Unit Label may be up to 10 characters (alphanumeric).

Labels are entered one character at a time. For **numbers, (.), (-), and (/)** characters, the keypad can be used. After each character is entered, the **[next] key** is pressed to move the cursor to the next character position.

If a **letter** or **alternate punctuation** character is desired, the **arrow keys are used** to scroll through a list of letters/punctuation. When the desired character is displayed, the **[next] key** is pressed to accept and move the cursor to the next character position.

Once all desired characters are entered, the **[enter] key** is pressed to accept the displayed Unit Number and Unit Label. The cursor returns to its position prior to starting the procedure.

A note is included in the procedure table explaining the use of the **[esc] key**. **Until the [enter] key** is pressed, the **[esc] key** can be used to **cancel** an entry.

The **[esc] key** can also be used **to go to the previous display screen**. For example, if the screen is currently on the Tanks Page, pressing the **[esc] key** displays the Main Menu screen.

## 4-8 TCU SCREEN FLOWCHART

Figure 4-21 shows the major TCU menu, data, and information screens.



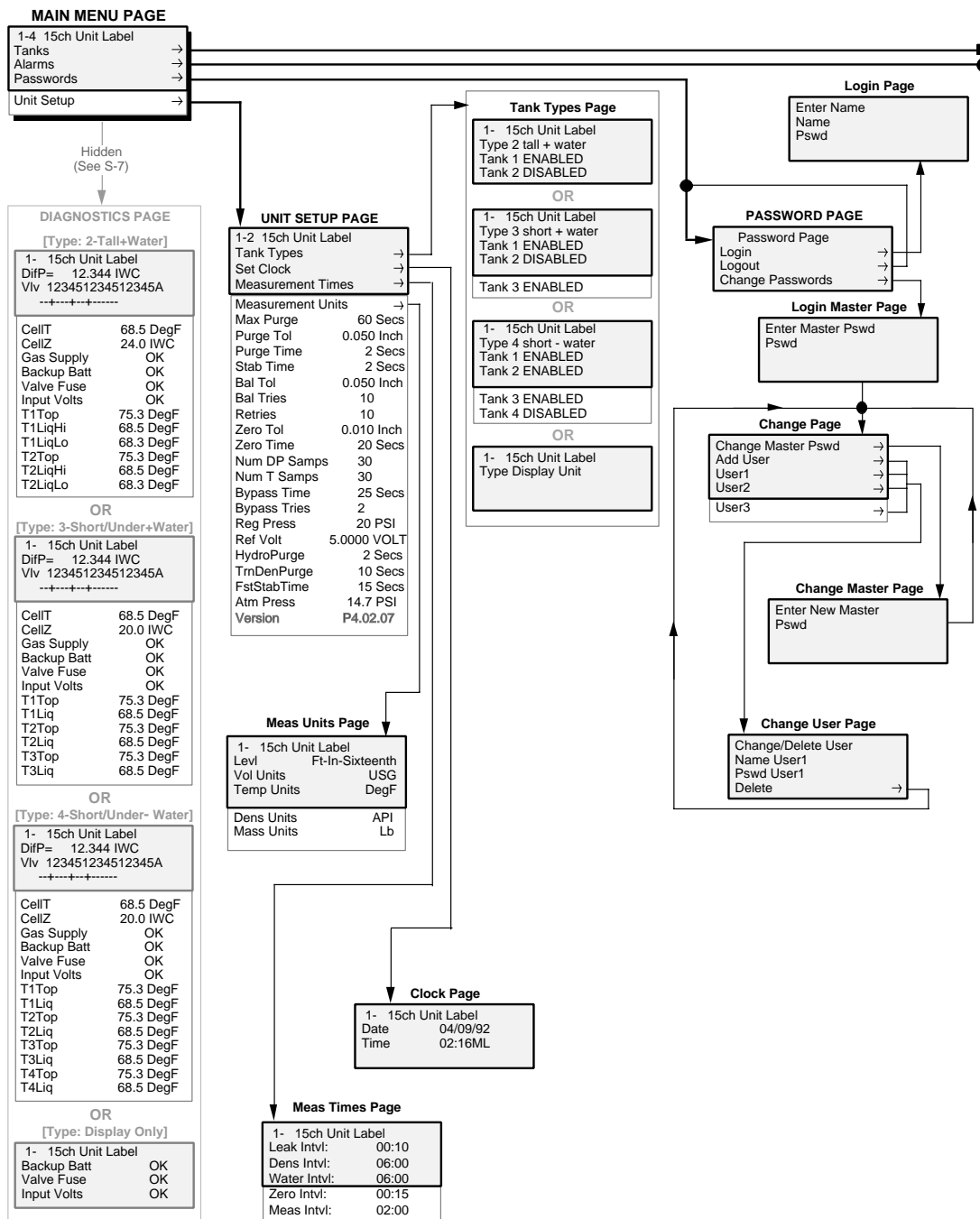


Figure 4-21 TCU Screen Flowchart

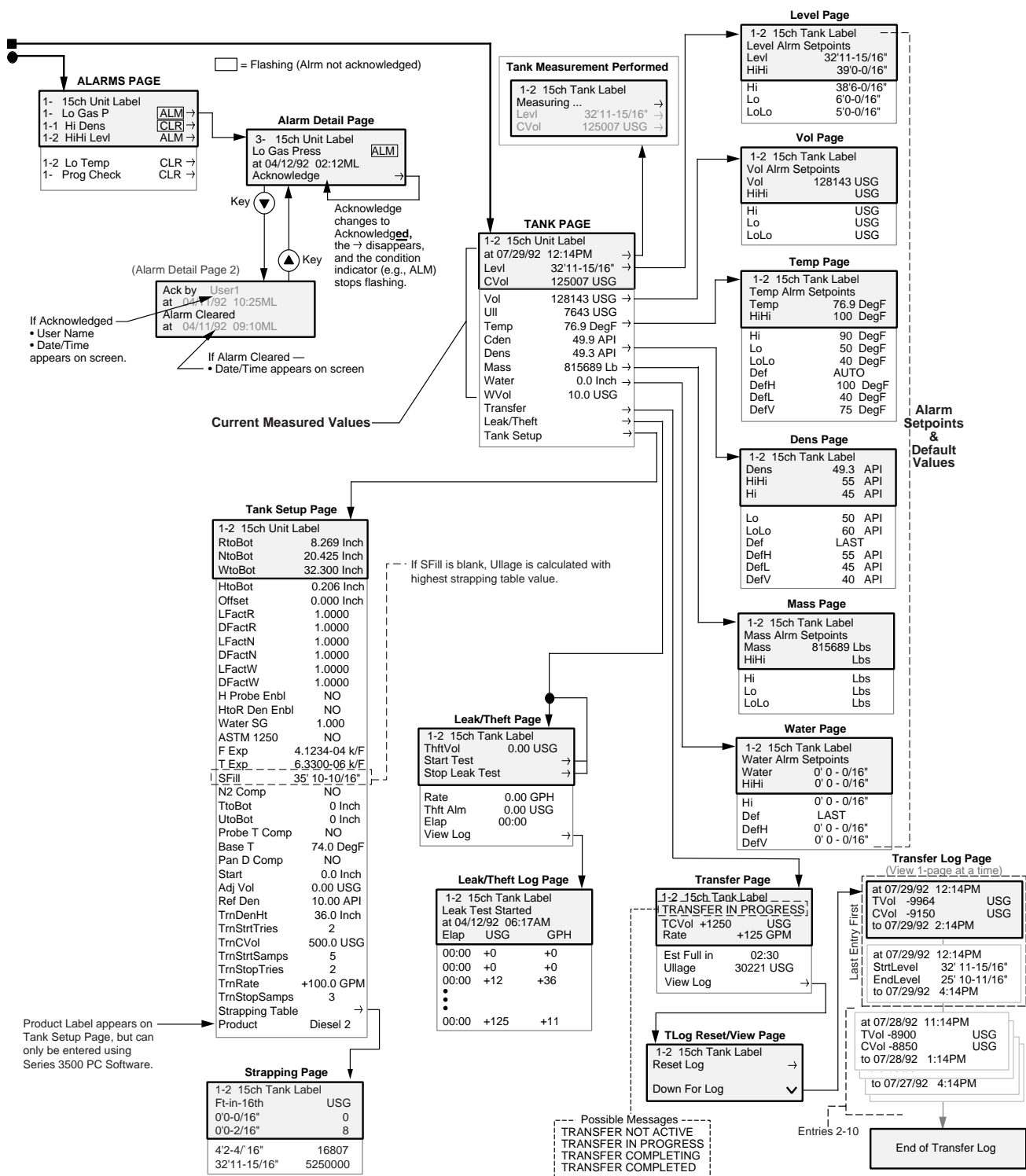


Figure 4-21 TCU Screen Flowchart (continued)



## SECTION 5

### SETUP AND VERIFICATION

#### 5-1 GENERAL

This section contains information and procedure tables for TCU setup and verification. Before performing any procedure in this section, review Section 4 — Basic Operation.

#### 5-2 REMOTE TCU OPERATION

Any TCU/TDU or host computer on the network can be used to view settings and measurement information, start tank measurements, start/stop leak/theft and transfer operations of any other TCU on the network. However, access is limited to view-only, if the remote TCU is “unlocked.”

#### 5-3 MULTIPLE TANKS

Each TCU can handle up to four tanks. When multiple tanks are connected to a TCU, each tank’s information must be entered into the TCU during configuration. Therefore, phases 6 and 7 in Table 5-1 are repeated for each tank connected to the TCU being configured.

#### 5-4 TCU SETUP STEPS

Setup of the Series 3500 TCU involves eight basic steps, as listed in Table 5-1. During initial setup, these steps should be performed in the order given.

**Table 5-1 Setup Phases**

PHASE	ITEM
<p style="text-align: center;"><b>NOTICE</b></p> <p>Ensure Backup Battery <b>DIP Switch #4 is ON</b>. Loss of power without backup battery on will cause all setup parameters and settings to be erased.</p>	
<b>1</b>	Perform “superboot” (see Section 7 (7-7.4) and Input a UNIT NUMBER for the TCU being setup
<b>2</b>	Set up User Names and Passwords (Master Password required) <ul style="list-style-type: none"> <li>• Change Master Password</li> <li>• Enter User Names/Passwords (1X per network-<b>see Note</b> on next pg.)</li> </ul>

**Table 5-1 Setup Phases (Cont.)**

PHASE	ITEM
<b>3</b>	Login (w/User Name and Password)
<b>4</b>	Enter Unit Label
<b>5</b>	UNIT SETUP — Settings/Data <u>Basic Settings</u> <ul style="list-style-type: none"> <li>• #/Type of Tanks</li> <li>• Clock Date/Time</li> <li>• Measurement Times</li> <li>• Measurement Units</li> </ul> <u>Unit Values</u> <ul style="list-style-type: none"> <li>• Maximum Purge Duration</li> <li>• Purge Tolerance</li> <li>• Purge Time</li> <li>• Stabilization Time</li> <li>• Balance Tolerance</li> <li>• Balance Tries</li> <li>• Retries</li> <li>• Zero Tolerance</li> <li>• Zero Time</li> <li>• Number of DP Samples</li> <li>• Number of T (temp.) Samples</li> <li>• Bypass Time</li> <li>• Bypass Tries</li> <li>• Regulator Pressure</li> <li>• Reference Voltage</li> <li>• HydroPurge</li> <li>• Transfer Density Purge</li> <li>• Fast Stabilization Time</li> <li>• Atmospheric Pressure</li> <li>• <i>Version *</i></li> </ul>
<b>6</b>	Select Tank Number/Enter Label (used for multiple tank configuration)

(continued on next page)

**Table 5-1 Setup Phases (Cont.)**

PHASE	ITEM
7	<p>TANK SETUP — Settings/Data (repeated for each tank connected to the TCU being configured)</p> <ul style="list-style-type: none"> <li>• Alarm Setpoints (Tank Page)</li> <li>• Basic Probe Measurements (RtoBot, NtoBot, WtoBot, and HtoBot)</li> <li>• Offset Calibration Value</li> <li>• Correction Factors (LFactR, DFactR, LFactN, DFactN, LFactW, DFactW)</li> <li>• H Probe Enbl</li> <li>• HtoR Enbl</li> <li>• Water SG</li> <li>• Fluid Expansion Factor</li> <li>• Tank Expansion Factor</li> <li>• Safe Fill Point</li> <li>• N2 Compensation</li> <li>• Probe T to Bottom Measurement (for nitrogen compensation)</li> <li>• Probe U to Bottom Measurement (for nitrogen compensation)</li> <li>• Probe Temperature Compensation</li> <li>• Base Temperature</li> <li>• Pan Density Compensation</li> <li>• Start Point (for Pan compensation)</li> <li>• Adjusted Volume</li> <li>• Reference Density</li> <li>• Transfer Density Height</li> <li>• Transfer Start Tries</li> <li>• Transfer Corrected Volume</li> <li>• Transfer Start Samples</li> <li>• Transfer Stop Tries</li> <li>• Transfer Rate</li> <li>• Transfer Stop Samples</li> <li>• Strapping Table Data</li> <li>• <i>Product Name</i> **</li> </ul>
8	<p>Calibration/Verification (repeated for each tank connected to the TCU being configured)</p>

\* Preset reference indicating firmware version (view only - cannot be changed).

\*\* Not entered locally. Product Name can only be entered using Series 3500 PC Software.

#### NOTICE

User names/levels/passwords entered directly into a TCU are active for that TCU only. They can only be used on the local TCU, unless similar users are setup on all TCUs — directly or via Barton's Series 3500 PC Software.

#### NOTICE (cont.)

User Names and Passwords entered or modified using the Barton Series 3500 PC Software are automatically distributed across the network to all connected TCUs/TDUs.

Any **users or passwords entered locally** on a TCU **will be erased** whenever the Series 3500 PC Software updates the user/password list.

### 5-5 INPUT/SETTING PROCEDURES OVERVIEW

#### 5-5.1 TCU Unit Number Assignment

When the physical installation is complete and the TCU power is ON, the SUPERBOOT procedure is performed (see Section 7 (7-7.4) for specific details). After the “superboot” is complete, a screen message is displayed that asks the user to enter a **Unit Number** for that TCU. To enter a Unit Number:

1. Enter the appropriate digit(s), using the keypad number keys (cursor automatically moves to next digit location when entering multiple digit (e.g., 11) unit numbers).
2. Press the [enter] key.  
Confirmation message is displayed.
3. Press [enter] key to accept or [esc] key to cancel.

The screen will then display the Main Menu — the TCU is now ready to be configured.

#### NOTICE

A Unit Number entry will be required whenever the TCU is superbooted, because the **superboot procedure erases all stored configuration, parameter, and log information**.

## 5-5.2 Setup Procedures

Procedure Tables 5-3 through 5-20 list the steps for setting Unit and Tank parameters and operating values (e.g., units of measure, alarm setpoints, measurement intervals, tank type, etc.).

During initial installation and setup, these procedures should be followed in order. For future reference, Table 5-2 lists procedure names and page locations.

**Table 5-2 Procedure Quick List**

PROCEDURE	TABLE	PAGE
Change Master Password Procedure	Table 5-3	5-4
Add/Edit Users/Passwords Procedure	Table 5-4	5-7
Login Procedure	Table 5-5	5-10
Unit Selection/Label Procedure	Table 5-6	5-12
Tank Types Procedure	Table 5-7	5-15
TCU Clock Procedure	Table 5-8	5-17
Measurement Times Procedure	Table 5-9	5-18
Measurement Units Procedure	Table 5-10	5-20
Unit Values Input Procedure	Table 5-12	5-22
Tank Selection/Label Procedure	Table 5-13	5-30
Tank Page Inputs	Table 5-14	5-32
Tank Setup Values Input Procedure	Table 5-23	5-47
Calibration Procedure		5-58
Verification		5-60
Logout	Table 5-25	5-60

## 5-6 TCU SETUP CHECKLIST

A TCU Setup Checklist Form is located at the back of this manual. The pages are on separate sheets for easier photocopying. This checklist may be reproduced without permission, as required.

## 5-7 PASSWORDS

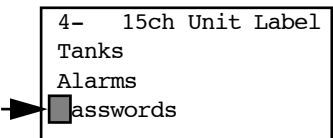
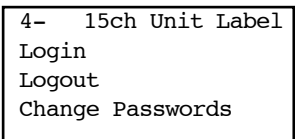
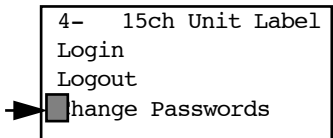

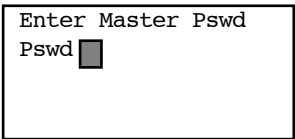
### 5-7.1 Change Master Password

The Master Password is required to enter or change User Names and Passwords. **It cannot be used to Login for normal operation.**

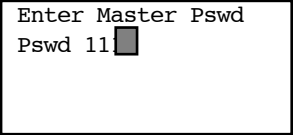
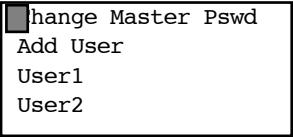
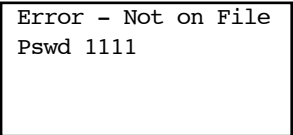


Once initial installation is complete, the Master Password should be changed to prevent unwanted changes.

The Master Password can be used while other users are logged on to other TCUs. However, only one Master Password can be used at a time on the network. If a second user attempts to enter the Master Password, an error message 'Master In Use' will be displayed.

**Table 5-3 Change Master Password Procedure**

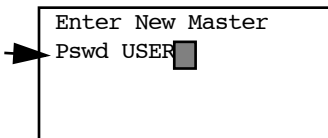
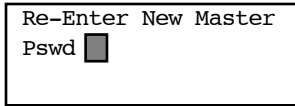
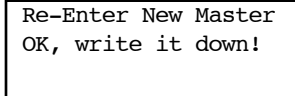
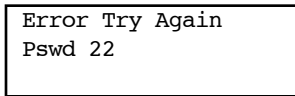
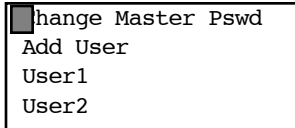
STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORDS line: (If cursor is on Passwords line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to PASSWORDS Page: <b>Press [enter] key.</b>		
3	Move cursor to CHANGE PASSWORDS line: (If cursor is on Change Passwords line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4 	Go to CHANGE PASSWORDS Page: <b>Press [enter] key.</b>		

**Table 5-3 Change Master Password Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
5	<p>ENTER MASTER PASSWORD (1-character at a time):  <b>For Number, (.), (-) and (/) keys</b>, press appropriate key.  <b>Then, press [next] key</b> to move cursor to next character.</p> <hr/> <p><b>Letter/Punctuation — press UP or DOWN Arrow key</b>, until desired character is displayed.  <b>Then, Press [next] key</b> to move cursor to next character.</p>		<p><b>Initial Setup:</b>  On initial setup, the default Master Password is <b>POL1</b>.</p>
Repeat Step 5, until all characters are entered.			
6	<p>Accept MASTER PASSWORD Entry:  <b>Press [enter] Key.</b></p>		Display goes to Change Page.
	<p><b>ERROR</b>  (Wrong password entered)</p>		Display will return to the Password Page — Steps 3-6 must be repeated.
7	<p>Select CHANGE MASTER PSWD.  <b>Press [enter] Key.</b></p>		
			



**Table 5-3 Change Master Password Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>8</b>	<b>ENTER NEW MASTER PASSWORD</b>		
<b>a)</b>	<p><b>Enter NEW Master Password.</b> (1-character at a time):  <b>For Number, (.), (-) and (/)</b> keys, press appropriate key.  <b>Then, press [next] key</b> to move cursor to next character.</p> <hr/> <p><b>Letter/Punctuation — press UP or DOWN Arrow key</b>, until desired character is displayed.  <b>Then, Press [next] key</b> to move cursor to next character.</p>		
<b>b)</b>	When all characters are entered, <b>Press [enter] Key</b> to accept.		
<b>c)</b>	<b>Re-enter NEW Master Password</b> and <b>Press [enter] key</b> to accept.	 <p>(message on screen for a few seconds)</p>	If the new password is verified, the screen displays a reminder message then returns to the Change Password Page.
	<b>ERROR</b>	 <p>(Error message on screen for a few seconds)</p> 	If the two password entries do not match, an error message is displayed, the screen returns to the Change Passwords Page, and the Master Password is not changed. Repeat Steps 7 and 8.
<p><b>NOTE:</b> The Master Password must be entered each time the Change Master Page is selected.  The system automatically logs out any user on the TCU whenever the Master Password is entered.  Login procedure must be performed after accessing the Master Password or User Change Pages.</p>			

## 5-7.2 Add Users/Passwords

The TCU has a two pre-configured Users with default passwords. One of these is at Level 1, (access only for viewing and acknowledgement of alarms). The second is at Level 2, (access for alarm acknowledgement and system configuration parameter changes).

User Names and passwords can be any combination of letters, numbers, and punctuation — up to 10 characters long.

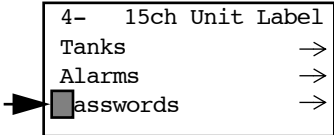
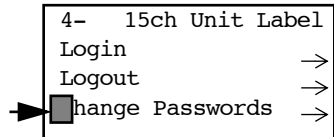
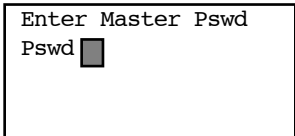
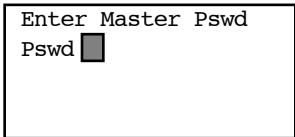
### NOTE

The Master Password is required to add or change a user/password.

### NOTICE

User names and passwords entered using this procedure are active for that TCU only. They can only be used on the local TCU, unless similar user names and passwords are entered on all TCUs — directly or via Barton's Series 3500 PC Software.

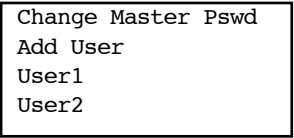
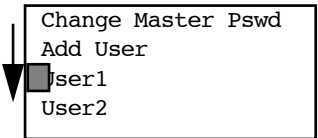
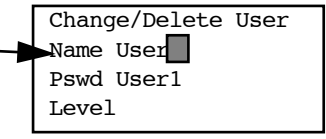
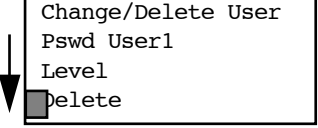
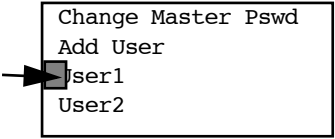
**Table 5-4 Add/Edit Users/Passwords Procedure**

STEP	ACTION	RESULT	NOTES
If this procedure is being done immediately after the Change Master Password procedure or the screen is displaying the <u>Change Passwords Page</u> , go to Step 7.			
1	At the MAIN MENU, move cursor to PASSWORDS line: (If cursor is on passwords line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		<b>Initial Setup:</b> On initial setup, the default Master Password is <b>POL1</b> .
2	Go to PASSWORD Page: <b>Press [enter] key.</b>  Then, move cursor to CHANGE PASSWORD line: <b>Press UP or Down Arrow key.</b>		
3	Go to CHANGE PASSWORDS Page: <b>Press [enter] key.</b>		
4	Enter MASTER PASSWORD (1-character at a time): <b>For Number, (.), (-) and (/) keys</b> , press appropriate key. <b>Then, press [next] key</b> to move cursor to next character. <hr/> <b>Letter/Punctuation — press UP or DOWN Arrow key</b> , until desired character is displayed. <b>Then, Press [next] key</b> to move cursor to next character.		

**Table 5-4 Add/Edit Users/Passwords Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
5	Accept MASTER PASSWORD Entry: <b>Press [enter] Key.</b>	<div>Change Master Pswd Add User User1 User2</div> <div>Or</div> <div>Error - Not on File Pswd 111</div>	If the wrong master password is entered or the password was incorrectly entered, an error message will briefly appear, then display returns to Password page. Steps 2-5 must be repeated.
6	<b>Add New User - Go to 6A or Edit/Delete User - Go to 6B</b>		
<b>6A — ADD NEW USER</b> (Note: To add multiple users, repeat Steps in 6A from the beginning, as needed.)			
a)	To ADD a USER: <b>Move cursor to ADD USER line.</b>	<div>Change Master Pswd Add User User1 User2</div>	
b)	Accept selection, <b>Press [enter] key.</b>	<div>Change/Delete User Name Pswd Level</div>	
c)	Enter User Name: • Move cursor to User Name line, if needed (Arrow keys) • <b>Press [next] key</b> • <b>Enter new user Name</b> (1-character at a time-see Step 4 for details on character entry) • <b>Press [enter] key</b> to accept	<div>Change/Delete User Name Pswd Level</div>	When this screen is first displayed, the cursor is on the Name line.
d)	Enter User Password: • <b>Move cursor to User Password line</b> , using Arrow keys • <b>Press [next] key</b> • <b>Enter new user Password</b> (1-character at a time-see Step 4 for details on character entry) • <b>Press [enter] key</b> to accept	<div>Change/Delete User Name User5 Pswd Level</div>	
e)	Enter User Level: • <b>Move cursor to Level line</b> , using Arrow keys • <b>Enter level number</b> , press desired number key. • <b>Press [enter] key</b> to accept	<div>Change/Delete User Name User5 Pswd Level</div>	

**Table 5-4 Add/Edit Users/Passwords Procedure (Cont.)**

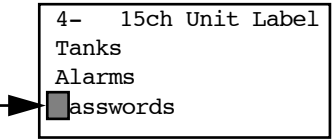
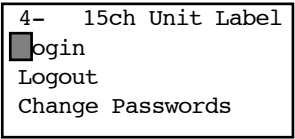
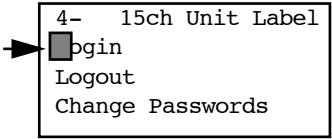
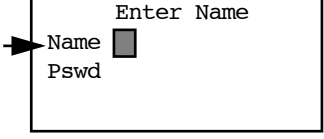
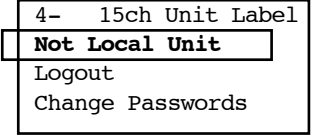

STEP	ACTION	RESULT	NOTES
f)	After User Name and Password are entered, <b>Press [esc] key</b> to accept User information.		
<b>6B — EDIT/DELETE USER (NAME/PASSWORD)</b>			
a)	<ul style="list-style-type: none"> <li>• <b>Move cursor to line to be changed</b> (Name or Password)</li> <li>• <b>Press [next] key</b></li> </ul>		
b)	<ul style="list-style-type: none"> <li>• <b>Enter Changes</b> (1-character at a time; <b>press [next] key</b> to move to next character - see Step 4 for details on character entry)</li> <li>• <b>Press [enter] key</b> to accept changes.</li> </ul>		
	<b>DELETE USER</b> (Currently displayed):		
	<ul style="list-style-type: none"> <li>• <b>Move cursor to Delete line</b></li> <li>• <b>Press [enter] key</b></li> </ul>		
c)	When all changes have been entered, <b>Press [esc] key</b> to return to Change Page		
<b>7</b>	When all additions and/or changes to users and passwords are complete, <b>Press [esc] key</b> to go to Password Page. To go to the Main Menu Page — Press [esc] key twice.		

## 5-8 LOGIN

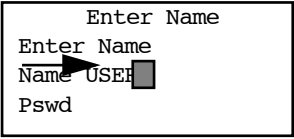
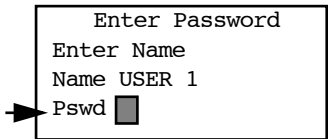
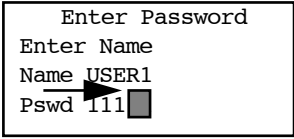
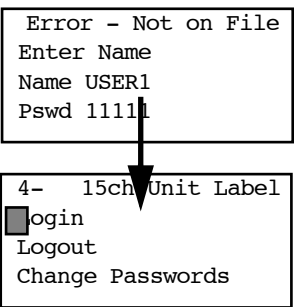
To continue with the TCU setup, a user must be logged-in (using User Name and Password entered in procedure listed in Table 5-4.

Once logged in, a user can change the local TCU's settings. A user cannot login while viewing accessing a remote TCU. Remote TCU access is limited to view-only for settings; and measurement, leak/theft, and transfer functions.

**Table 5-5 Login Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORD line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		<b>Default Users:</b> User 1 (Level 1 Access) Name = 1; Password = 1  User 2 (Level 2 Access) Name = 2; Password = A2.
2	Go to PASSWORD Page: <b>Press [enter] key.</b>		
3	Cursor starts at Login line. <b>If cursor is on Login line, go to Step 4...</b>  ...otherwise, Press UP Arrow key to move cursor to Login line.		
4	Go to LOGIN Page: <b>Press [enter] key.</b>		If login page is accessed, go to Step 5.
	<b>Error</b>		If Login line changes to "Not Local Unit," the local TCU is currently being used to view a remote TCU (Unit No. set to remote TCU's Unit No.) — <b>Login is not possible.</b>
		If "Not Local Unit" Error Message is displayed and login is desired, go to Unit Selection/Label Procedure (Table 5-6) on Page 5-12, change Unit No. to local unit, then repeat the login procedure.	

**Table 5-5 Login Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
5	<p>Enter User NAME (1-character at a time):  <b>For Number, (.), (-) and (/) keys</b>, press appropriate key.  <b>Then, press [next] key</b> to move cursor to next character.</p> <hr/> <p><b>Letter/Punctuation — press UP or DOWN Arrow key</b>, until desired character is displayed.  <b>Then, Press [next] key</b> to move cursor to next character.</p>	<p>Selected character changes to number, symbol, or letter entered.</p> 	<p><b>Default Users:</b>  User 1 (Level 1 Access)  Name = 1; Password = 1</p> <p>User 2 (Level 2 Access)  Name = 2; Password = A2.</p>
Repeat Step 5, until all characters are entered.			
6	<p>When all characters are entered, ACCEPT ENTRY:  <b>Press [enter] key.</b></p>		<p>Cursor automatically moves to the password line, ready for entry.</p>
7	<p>Enter PASSWORD (1-character at a time):</p> <p>(See Step 5 for specific procedures)</p>	<p>Selected character changes to number, symbol, or letter entered.</p> 	<p>Refer to Section 4 for information on entering data and information.</p>
8	<p>When all password characters are entered, ACCEPT ENTRY:  <b>Press [enter] key.</b></p>	<p>Error:</p> 	<p>Error message appears for a few seconds, then the display returns to the Password Page.</p> <p>REPEAT STEPS 3 - 9 w/correct user name and password.</p>
9	To return to the MAIN MENU, Press [esc] key.		

## 5-9 UNIT SELECTION/LABEL

This procedure is used to select which TCU/TDU (local or on the network) will be active and to assign the **local** TCU/TDU unit an alphanumeric label (up to 10 characters).

### Unit Numbers

Whenever a TCU is superbooted, a message is displayed requesting a Unit Number be entered. Once entered, the local TCU can be accessed from any other TCU or host computer on the network by specifying its unit number.

### Unit Selection

The Unit Number can be changed from the following TCU screen pages: **Main Menu** and **Tank Page**.

### Unit Label

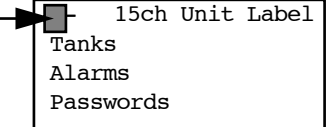
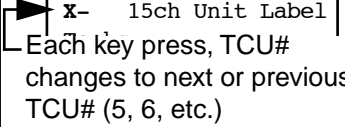
A Unit Label can only be entered locally or via Series 3500 PC Software, it cannot be entered from another TCU on the network. A user must be logged in (TCU “unlocked”) to enter a label.

### Network Access

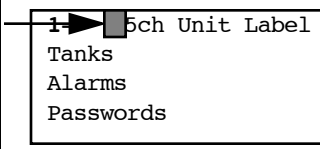
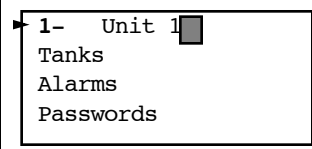
If the TCU being used is locked, the user has view access to any TCU on the network. An “**unlocked**” TCU (user logged in) **cannot** be used to **access** a **remote TCU**.

A TCU cannot be used to change settings, acknowledge alarms, or input strapping table information on remote TCUs. These operations must be done locally or via the Series 3500 PC Software.

**Table 5-6 Unit Selection/Label Procedure**

STEP	ACTION	RESULT	NOTES
<b>1</b>	<b>UNIT SELECTION</b> (From Main Menu or Tank Page)		
<b>a)</b>	Move cursor to the top line: <b>Press [tank] key.</b>		<p>If cursor does not move to top line, Unit # is not accessible from that page.</p> <p>If the TANK key is pressed twice (2X) in succession, the local TCU being operated becomes the active unit and its current Unit number is displayed.</p>
<b>b)</b>	If desired unit # is currently displayed, go to Step (1c).		
	Select Unit Number: <b>Press UP or DOWN Arrow keys</b> until desired Unit Number is displayed.		<p>Only TCUs on the network will be displayed. If the local TCU is “unlocked,” the following message screen will be displayed:</p> <div style="border: 1px solid black; padding: 5px; text-align: center;">Logout Required</div> <p><b>LOGOUT</b> (see Table 5-26), then repeat the Unit Selection procedure.</p>
<b>c)</b>	If the desired unit# is currently displayed and <b>no label</b> is to be entered, go to <b>Step 3</b> . If a <b>unit label</b> is to be entered, go to <b>Step 2</b> .		

**Table 5-6 Unit Selection/Label Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>2</b>	<b>ENTER UNIT LABEL</b> (Must be on Main Menu Page)		
<b>a)</b>	With cursor at unit number position, move cursor to Label position: <b>Press [next] key</b>		
<b>b)</b>	Enter TCU UNIT LABEL: (Must be on Main Menu Page, with user logged in)  Enter Label (1-character at a time): <b>For Number, (.), (-) and (/) keys</b> , press appropriate key. <b>Then, press [next] key</b> to move cursor to next character.  <b>Letter/Punctuation — press UP or DOWN Arrow key</b> , until desired character is displayed. <b>Then, Press [next] key</b> to move cursor to next character.		Unit Label can be up to 10 characters long.
<b>c)</b>	<b>Repeat Step 2b</b> for each label character to be entered.		
	Once label entry is started, <b>to cancel entry, Press [esc] key</b> to return cursor to position prior to Step 1 of this procedure. The Label returns to its original setting.		
<b>3</b>	Accept currently displayed Unit Number and Label: <b>Press [enter] key.</b>	Accepts Unit # entry.	Cursor returns to position prior to Step 1 of this procedure.



## 5-10 UNIT SETUP

The Unit Setup Page is used to input and/or select the following:

### Basic Unit Settings

- **Tank Types**  
Specifies the type and number of tanks.
- **System Clock** (Date/Time)
- **Measurement Times**  
Specifies interval or specific times of measurements
- **Measurement Units**  
Specifies various measurement and calculation units.

### Unit Value Inputs

- **Max Purge Time**  
Maximum time (min.) the TCU will attempt to purge measurement lines during purge stability testing.
- **Purge Tolerance Value**  
Amount (inches-w.c.) allowed between 2 subsequent readings during purge stability testing.
- **Purge Time**  
Number of seconds used to purge measurement tubes between repeat readings of hydrostatic head or density
- **Stabilization Time**  
Number of seconds allowed between subsequent DPE readings during hydrostatic head measurement, density measurement, zero checking, and purge stability checking.
- **Balance Tolerance Value**  
Amount (inches-w.c.) allowed between 2 subsequent readings during hydrostatic head and density measurements.
- **Balance Tries Value**  
Maximum number of DPT readings allowed (at an interval of Stab Time) during hydrostatic head or density measurements to achieve a stability with Bal Tol.
- **Retries Value**  
Number of times the TCU attempts to achieve 2 successive hydrostatic or density measurements within Bal Tol.

- **Zero Tolerance**  
Amount (inches-w.c.) allowed between 2 subsequent readings during zero checking.
- **Zero Time**  
Number of seconds allowed for the DPT to stabilize during zero checking.
- **Number of DP Samples** (Num DP Samps)  
Number of A to D samples taken for each Differential Pressure (DP) reading.
- **Number of Temp. Samples** (NumTempSamps)  
Number of temperature samples taken for each Differential Pressure (DP) reading.
- **Bypass Time** (Bypass Time)  
Number of seconds each line in a tank is purged at full bypass pressure, if the TCU cannot achieve a stable reading before Max Purge seconds have expired.
- **Bypass Tries** (Bypass Tries)  
Number of bypass operations that will be attempted before aborting a tank measurement. A 'Bypass Failure' alarm is generated, if Bypass Tries is exceeded.
- **Reg Press** (Regulator Pressure)  
The regulator pressure setting on the nitrogen supply.
- **Ref Volt** (Reference Voltage)  
A factory parameter used in temperature compensation. The specific value is indicated on the TCU Main Circuit Board (lower right corner). Default is 5.0000 volts.
- **HydroPurge**  
Number of seconds used to purge for hydrostatic head pressure during continuous measurement.
- **Transfer Density Purge** (TrnDenPurge)  
Number of seconds used to purge the density measurement tubes during transfer.
- **Fast Stabilization Time** (FstStabTime)  
Number of seconds allowed before taking DPE reading during hydrostatic head measurement and transfer density measurement.
- **Atmospheric Pressure** (AtmPress)  
Atmospheric pressure used for nitrogen compensation; value in PSI.

These settings and values are specific to a TCU.

### 5-10.1 Tank Types

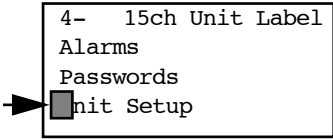
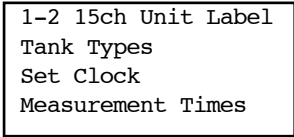
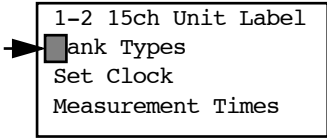
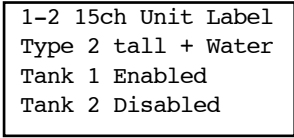
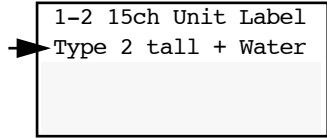

The procedure in Table 5-7 is used to set the number and type of tanks connected to a single TCU.

Available tanks, as determined by Tank Type selected, are either enabled (in use) or disabled.

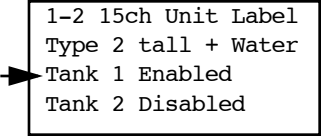
### Tank Types:

- 2 Tall + Water
- 3 Short + Water
- 4 Short - Water
- Display Unit (No Tanks)

**Table 5-7 Tank Types Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to UNIT SETUP line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key</b> to scroll display until cursor is on Unit Setup line.		
2	Go to UNIT SETUP Page: <b>Press [enter] key.</b>		
3	Move cursor to TANK TYPES line: (If cursor is on Change Password line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to TANK TYPES Page: <b>Press [enter] key.</b>		
5	Set Tank Type: • <b>Press [next] key</b> to scroll through list of tank types • When desired tank type is displayed, <b>Press [enter] key</b> to accept.		<u>Types Available:</u> • 2 Tall + Water • 3 Short + Water • 4 Short - Water • Display Unit
	<b>Note:</b> If Display Unit was selected, no tank type information or usage selections will be displayed. <b>Press [esc] key</b> to return to the Unit Setup Page.		

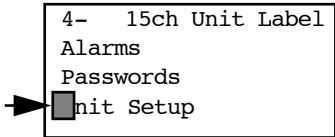
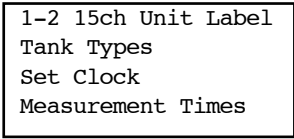
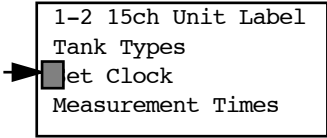
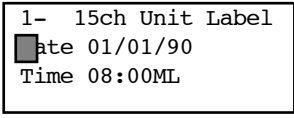
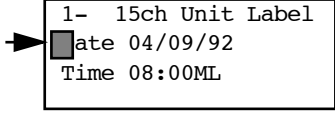
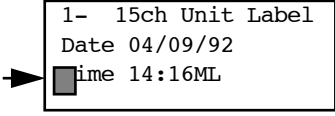
**Table 5-7 Tank Types Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	<p>Set Tank Usage for each Type shown (1-4) — <b>Yes</b> indicates tank used, <b>No</b> indicates not used.</p> <ul style="list-style-type: none"> <li>• <b>Cursor to desired line</b></li> <li>• <b>Press [next] key</b> to change choice (Enabled or Disabled)</li> <li>• <b>Press [enter] key</b> to accept (cursor returns to beginning of line)</li> <li>• <b>Repeat for each type selection</b></li> </ul>		
7	<p>When tank type has been entered and all type usage selections have been set, <b>Press [esc] key</b> to return to the Unit Setup Page.</p>		

## 5-10.2 Set Clock

The TCUs internal clock must be set to the correct date and time (in 24-hour/Military units) in order to ensure accurate log information.

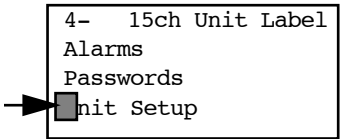
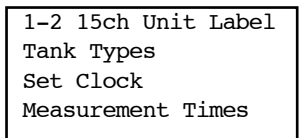
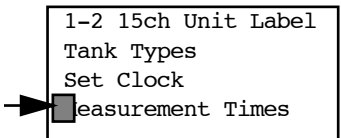
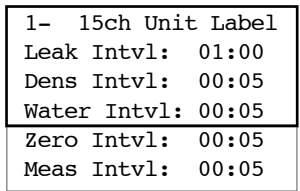

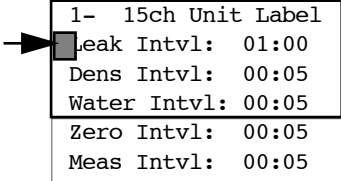
**Table 5-8 TCU Clock Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to UNIT SETUP line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key</b> to scroll display until cursor is on Unit Setup line.	 <pre> 4- 15ch Unit Label Alarms Passwords Unit Setup           </pre>	
2	Go to UNIT SETUP Page: <b>Press [enter] key.</b>	 <pre> 1-2 15ch Unit Label Tank Types Set Clock Measurement Times           </pre>	
3	Move cursor to SET CLOCK line: (If cursor is on Set Clock line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Tank Types Set Clock Measurement Times           </pre>	
4	Go to Set Clock Page: <b>Press [enter] key.</b>	 <pre> 1- 15ch Unit Label Date 01/01/90 Time 08:00ML           </pre>	
5	Set DATE: (Cursor starts on Date line) • <b>Enter current Date (digits only)</b> - use MM/DD/YY format [Entries must be valid two-digit dates (e.g., March = 03)]	 <pre> 1- 15ch Unit Label Date 04/09/92 Time 08:00ML           </pre>	Once entry has started, the date must be completely entered, action cannot be cancelled. When complete, cursor returns to start of line.
6	Set TIME: • <b>Move cursor to date line</b> • <b>Enter current Date (digits only)</b> - use HH:MM format (cursor automatically returns to beginning of line when date entry is complete)	 <pre> 1- 15ch Unit Label Date 04/09/92 Time 14:16ML           </pre>	Use appropriate Arrow Key to move from Date to Time line and back.
7	When date and time are set, <b>Press [esc] key</b> to return to the Unit Setup Page.		

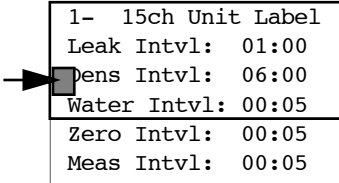
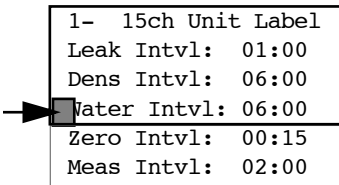
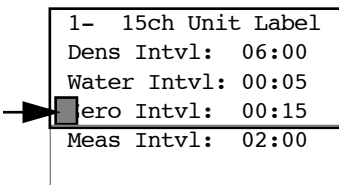
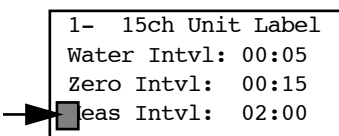
### 5-10.3 Measurement Times

The Measurement Times Page is used to set how often a measurement is performed.

**Table 5-9 Measurement Times Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to UNIT SETUP line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key</b> to scroll display until cursor is on Unit Setup line.	 <pre> 4- 15ch Unit Label Alarms Passwords Unit Setup           </pre>	
2	Go to UNIT SETUP Page: <b>Press [enter] key.</b>	 <pre> 1-2 15ch Unit Label Tank Types Set Clock Measurement Times           </pre>	
3	Move cursor to MEASUREMENT TIMES line: (If cursor is on Measurement Times line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Tank Types Set Clock Measurement Times           </pre>	
4	Go to Measurement Times Page: <b>Press [enter] key.</b>	 <pre> 1- 15ch Unit Label Leak Intvl: 01:00 Dens Intvl: 00:05 Water Intvl: 00:05 Zero Intvl: 00:05 Meas Intvl: 00:05           </pre>	Leak Intvl = HH:MM Dens Intvl = HH:MM Water Intvl = HH:MM Zero Intvl = HH:MM Meas Intvl = MM:SS
5 	Enter LEAK INTERVAL (Intvl): • <b>Move cursor to Leak Intvl line</b> • <b>Enter Leak Interval (HH:MM)-digits only</b> • <b>Press [enter] key</b> to accept	 <pre> 1- 15ch Unit Label Leak Intvl: 01:00 Dens Intvl: 00:05 Water Intvl: 00:05 Zero Intvl: 00:05 Meas Intvl: 00:05           </pre>	Suggested Leak Interval Value = 01:00

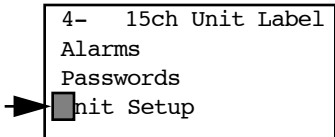
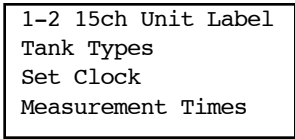
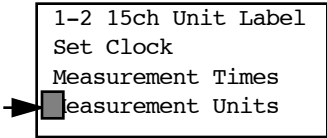
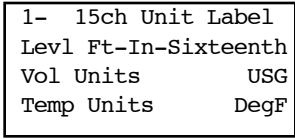
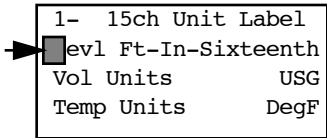
**Table 5-9 Measurement Times Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	Enter DENSITY INTERVAL (Intvl): • <b>Move cursor to Dens Intrvl line</b> • <b>Enter Dens Intvl (HH:MM)</b> - digits only • <b>Press [enter] key</b> to accept	 <pre> 1- 15ch Unit Label Leak Intvl: 01:00 Dens Intvl: 06:00 Water Intvl: 00:05 Zero Intvl: 00:05 Meas Intvl: 00:05           </pre>	Suggested Density Interval Value = 06:00 (six hours)
7	Enter WATER INTERVAL (Intvl): • <b>Move cursor to Water Intrvl line</b> • <b>Enter Water Intvl (HH:MM)</b> - digits only • <b>Press [enter] key</b> to accept	 <pre> 1- 15ch Unit Label Leak Intvl: 01:00 Dens Intvl: 06:00 Water Intvl: 06:00 Zero Intvl: 00:15 Meas Intvl: 02:00           </pre>	Suggested Water Interval Value = 06:00 (six hours)
8	Enter ZERO INTERVAL (Intvl): • <b>Move cursor to Zero Intrvl line</b> • <b>Enter Zero Intvl (HH:MM)</b> - digits only • <b>Press [enter] key</b> to accept	 <pre> 1- 15ch Unit Label Dens Intvl: 06:00 Water Intvl: 00:05 Zero Intvl: 00:15 Meas Intvl: 02:00           </pre>	Suggested Zero Interval Value = 00:15 (15 minutes)
9	Enter MEASUREMENT INTERVAL (Intvl): • <b>Move cursor to Meas Intrvl line</b> • <b>Enter Meas Intvl (MM:SS)</b> - digits only • <b>Press [enter] key</b> to accept	 <pre> 1- 15ch Unit Label Water Intvl: 00:05 Zero Intvl: 00:15 Meas Intvl: 02:00           </pre>	Suggested Measurement Interval Value = 02:00 (two minutes)
When all entries are complete, <b>Press [esc] key</b> to return to the Unit Setup Page.			

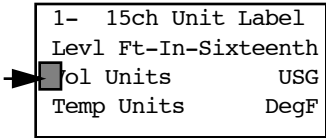
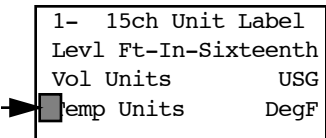
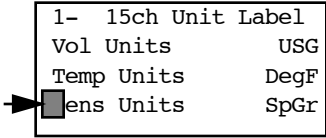
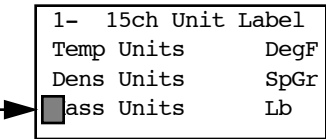
## 5-10.4 Measurement Units

The Measurement Units Page is used to set UNITS of MEASUREMENT for Level, Volume, Temperature, Density, and Mass.

**Table 5-10 Measurement Units Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to UNIT SETUP line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key</b> to scroll display until cursor is on Unit Setup line.	 <pre> 4- 15ch Unit Label Alarms Passwords Unit Setup           </pre>	
2	Go to UNIT SETUP Page: <b>Press [enter] key.</b>	 <pre> 1-2 15ch Unit Label Tank Types Set Clock Measurement Times           </pre>	
3	Move cursor to MEASURE- MENT UNITS line: (If cursor is on Measurement Times line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Set Clock Measurement Times Measurement Units           </pre>	
4	Go to Measurement Units Page: <b>Press [enter] key.</b>	 <pre> 1- 15ch Unit Label Levl Ft-In-Sixteenth Vol Units      USG Temp Units     DegF           </pre>	
5	Select LEVEL UNITS: • <b>Move cursor to Levl line.</b> • <b>Press [next] key</b> to scroll through list of choices. • When desired unit is displayed, <b>Press [enter] key</b> to accept.	 <pre> 1- 15ch Unit Label Levl Ft-In-Sixteenth Vol Units      USG Temp Units     DegF           </pre>	Level Units Available: • 8ths • 10ths • 16ths • Meters <b>Note:</b> Level units set here will be used throughout system.

**Table 5-10 Measurement Units Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	Select VOLUME UNITS: • <b>Move cursor to Vol line.</b> • <b>Press [next] key</b> to scroll through list of choices. • When desired unit is displayed, <b>Press [enter] key</b> to accept.		Volume Units Available: • USG • ImpG • Met3 • BBL <b>Note:</b> Volume units set here will be used throughout system.
7	Select TEMPERATURE UNITS: • <b>Move cursor to Temp line.</b> • <b>Press [next] key</b> to scroll through list of choices. • When desired unit is displayed, <b>Press [enter] key</b> to accept.		Temperature Units Available: • DegF • DegC <b>Note:</b> Temp. units set here will be used throughout system.
8	Select DENSITY UNITS: • <b>Move cursor to Dens line.</b> • <b>Press [next] key</b> to scroll through list of choices. • When desired unit is displayed, <b>Press [enter] key</b> to accept.		Density Units Available: • SpGr • API <b>Note:</b> Density units set here will be used throughout system.
9	Select MASS UNITS: • <b>Move cursor to Mass line.</b> • <b>Press [next] key</b> to scroll through list of choices. • When desired unit is displayed, <b>Press [enter] key</b> to accept.		Mass Units Available: • Lb • Kg • Ton • LTon <b>Note:</b> Mass units set here will be used throughout system.
10	When all entries are made, <b>Press [esc] key</b> to return to the Units Setup Page.		



### 5-10.5 Unit Values

The following values are input from the Unit Setup Page:

**Table 5-11 Unit Value Input Steps**

Unit Value	Step
Maximum Purge Time	3
Purge Tolerance	4
Purge Time	5
Stabilization Time	6
Balance Tolerance	7
Balance Tries	8
Retries	9
Zero Tolerance	10
Zero Time	11
Number of DP Samples	12
Number of Temperature Samples	13
Bypass Time	14
Bypass Tries	15

**Table 5-11 Unit Value Input Steps (Cont.)**

Unit Value	Step
Regulator Pressure	16
Reference Voltage	17
Hydrostatic Purge	18
Transfer Density Purge Time	19
Fast Stabilization Time	20
Atmospheric Pressure	21

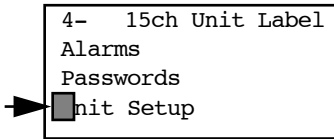

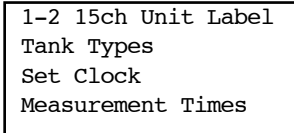
Table 5-12 lists the steps for inputting the unit values listed in Table 5-11. These values are listed in the order displayed in the Unit Setup Page.

The step numbers listed in Table 5-11 correspond to those in Table 5-12 — for reference when changing specific values in the future.

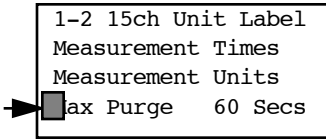
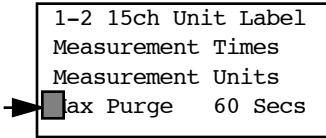
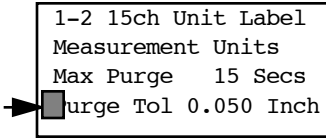
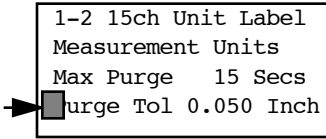
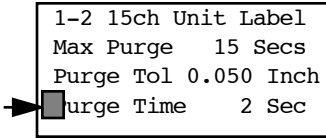

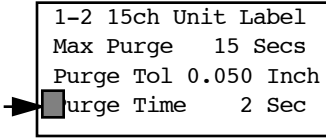
#### NOTE

The Version Number at the bottom of the Unit Setup Page is for reference only - it cannot be changed.

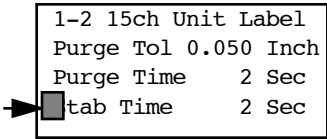
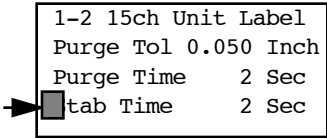
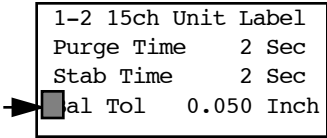
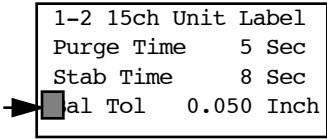
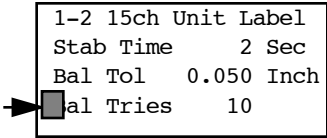
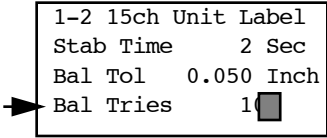
**Table 5-12 Unit Values Input Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to UNIT SETUP line: (If cursor is on Unit Setup line, go to Step 2) <b>Press UP or DOWN Arrow key</b> to scroll display until cursor is on Unit Setup line.		
2 	Go to UNIT SETUP Page: (If display is on the Unit Setup Page, go to Step 3) <b>Press [enter] key.</b>		

**Table 5-12 Unit Values Input Procedure (Cont.)**

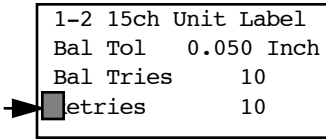
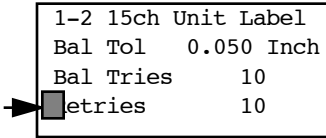
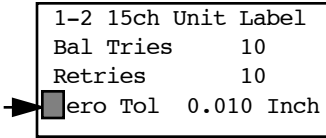
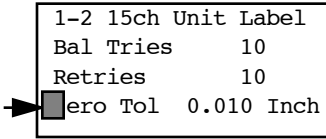
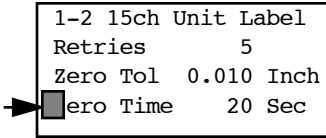
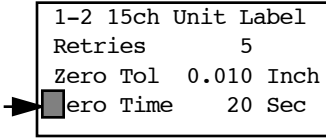

STEP	ACTION	RESULT	NOTES
<b>3</b>	<b>INPUT MAXIMUM PURGE</b>		
<b>a)</b>	Move cursor to Max Purge line: (If cursor is on Max. Purge line, go to Step 3b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Measurement Times Measurement Units Max Purge  60 Secs </pre>	
<b>b)</b>	Enter MAXIMUM PURGE: • <b>Enter value</b> (decimal point + digits) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Measurement Times Measurement Units Max Purge  60 Secs </pre>	Suggested Max. Purge Value = 60 sec.
<b>4</b>	<b>INPUT PURGE TOLERANCE</b>		
<b>a)</b>	Move cursor to Purge Tolerance line (If cursor is on Max. Purge line, go to Step 4b): <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Measurement Units Max Purge  15 Secs Purge Tol  0.050 Inch </pre>	
<b>b)</b>	Enter PURGE TOLERANCE: • <b>Enter value</b> (decimal point + digits) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Measurement Units Max Purge  15 Secs Purge Tol  0.050 Inch </pre>	Suggested Purge Tol. Value = 0.050 Inch
<b>5</b>	<b>INPUT PURGE TIME</b>		
<b>a)</b>	Move cursor to Purge Time line: (If cursor is on Purge Time line, go to Step 5b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Max Purge  15 Secs Purge Tol  0.050 Inch Purge Time  2 Sec </pre>	
<b>b)</b> 	Enter PURGE TIME: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Max Purge  15 Secs Purge Tol  0.050 Inch Purge Time  2 Sec </pre>	Suggested Purge Time Value = 2 sec.

**Table 5-12 Unit Values Input Procedure (Cont.)**

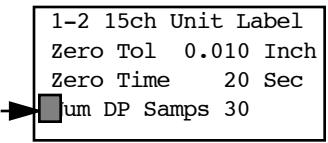
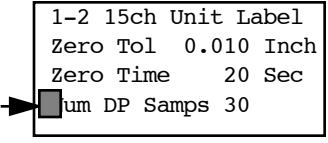
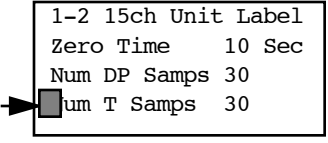
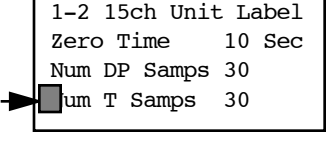
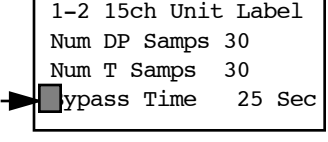
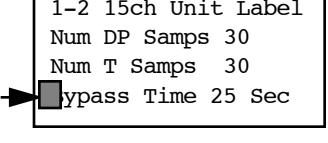

STEP	ACTION	RESULT	NOTES
<b>6</b>	<b>INPUT STABILIZATION TIME</b>		
a)	Move cursor to Stabilization Time line: (If cursor is on Stabilization Time line, go to Step 6b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Purge Tol 0.050 Inch Purge Time 2 Sec tab Time 2 Sec </pre>	
b)	Enter STABILIZATION TIME: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Purge Tol 0.050 Inch Purge Time 2 Sec tab Time 2 Sec </pre>	Suggested Stabilization Time Value = 2 sec.
<b>7</b>	<b>INPUT BALANCE TOLERANCE</b>		
a)	Move cursor to Balance Tolerance line: (If cursor is on Balance Tolerance line, go to Step 7b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Purge Time 2 Sec Stab Time 2 Sec al Tol 0.050 Inch </pre>	
b)	Enter BALANCE TOLERANCE: • <b>Enter value</b> (digits and decimal point only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Purge Time 5 Sec Stab Time 8 Sec al Tol 0.050 Inch </pre>	Suggested Balance Tol. Value = 0.050 Inch
<b>8</b>	<b>INPUT BALANCE TRIES</b>		
a)	Move cursor to Balance Tries line: (If cursor is on Balance Tries line, go to Step 8b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Stab Time 2 Sec Bal Tol 0.050 Inch al Tries 10 </pre>	
b)	Enter BALANCE TRIES: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Stab Time 2 Sec Bal Tol 0.050 Inch Bal Tries 1 </pre>	Suggested Bal. Tries Value = 10



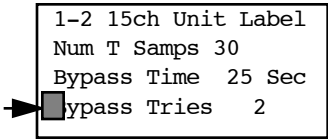
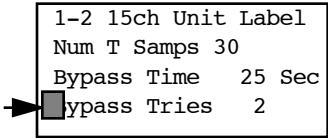
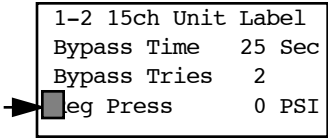
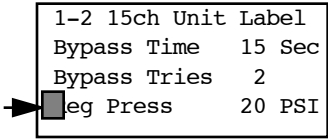
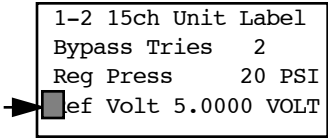
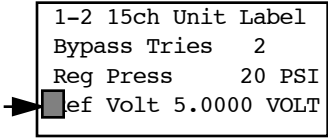
**Table 5-12 Unit Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>9</b>	<b>INPUT RETRIES</b>		
<b>a)</b>	Move cursor to Retries line: (If cursor is on Retries line, go to Step 9b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter RETRIES: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Retries Value = 10
<b>10</b>	<b>INPUT ZERO TOLERANCE</b>		
<b>a)</b>	Move cursor to Zero Tol line: (If cursor is on Zero Tol line, go to Step 10b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter ZERO TOLERANCE: • <b>Enter value</b> (digits and decimal point only) <b>Press [enter] key</b> to accept		Suggested Zero Tol. Value = 0.010
<b>11</b>	<b>INPUT ZERO TIME</b>		
<b>a)</b>	Move cursor to Zero Time line: (If cursor is on Zero Time line, go to Step 11b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter ZERO TIME: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Zero Time Value = 20 sec.
			

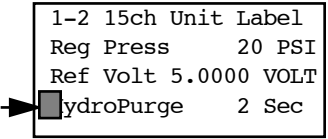
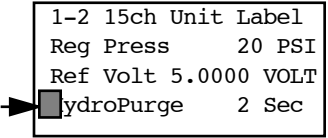
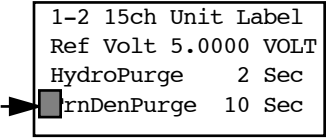
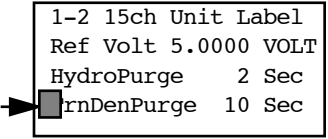
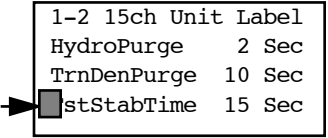
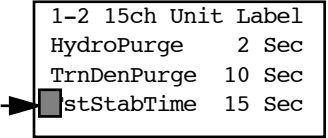

**Table 5-12 Unit Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>12</b>	<b>INPUT NUMBER OF DP SAMPLES</b>		
a)	Move cursor to Num DP Samps line: (If cursor is on Num DP Samps line, go to Step 12b) <b>Press UP or DOWN Arrow key.</b>		
b)	Enter NUMBER OF DP SAMPLES: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Num. of DP Samples Value = 30
<b>13</b>	<b>INPUT NUMBER OF TEMPERATURE SAMPLES</b>		
a)	Move cursor to Num T Samps line: (If cursor is on Num T Samps line, go to Step 13b) <b>Press UP or DOWN Arrow key.</b>		
b)	Enter Num T Samps Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Num. of Temperature Samples Value = 30
<b>14</b>	<b>BYPASS TIME</b>		
a)	Move cursor to Bypass Time line: (If cursor is on Bypass Time line, go to Step 14b) <b>Press UP or DOWN Arrow key.</b>		
b)	Enter Bypass Time Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Bypass Time Value = 25 seconds
			

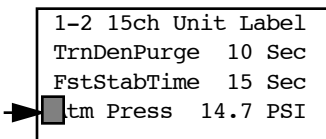
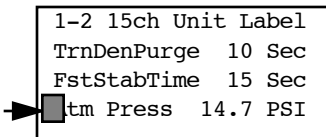
**Table 5-12 Unit Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>15</b>	<b>BYPASS TRIES</b>		
<b>a)</b>	Move cursor to Bypass Tries line: (If cursor is on Bypass Tries line, go to Step 15b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter Bypass Tries Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Bypass Tries Value = 2
<b>16</b>	<b>REG PRESS</b>		
<b>a)</b>	Move cursor to Reg Press line: (If cursor is on Reg Press line, go to Step 16b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter Reg Press Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept		Suggested Reg Press Value = 20 PSI
<b>17</b>	<b>REF VOLT</b>		
<b>a)</b>	Move cursor to Ref Volt line: (If cursor is on Ref Volt line, go to Step 17b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter Ref Volt Value: • <b>Enter value</b> (digits and decimal point only) <b>Press [enter] key</b> to accept		<b>Note:</b> Ref. Voltage value for each TCU is listed on the TCU's Main Circuit Board (lower right corner).

**Table 5-12 Unit Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>18</b>	<b>INPUT HYDROSTATIC PURGE TIME</b>		
<b>a)</b>	Move cursor to HydroPurge line: (If cursor is on HydroPurge line, go to Step 18b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Reg Press      20 PSI Ref Volt 5.0000 VOLT HydroPurge     2 Sec </pre>	
<b>b)</b>	Enter HydroPurge Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Reg Press      20 PSI Ref Volt 5.0000 VOLT HydroPurge     2 Sec </pre>	Suggested Hydrostatic Purge Time Value = 2 seconds
<b>19</b>	<b>INPUT TRANSFER DENSITY PURGE TIME</b>		
<b>a)</b>	Move cursor to TrnDenPurge line: (If cursor is on TrnDenPurge line, go to Step 19b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label Ref Volt 5.0000 VOLT HydroPurge     2 Sec TrnDenPurge    10 Sec </pre>	
<b>b)</b>	Enter TrnDenPurge Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label Ref Volt 5.0000 VOLT HydroPurge     2 Sec TrnDenPurge    10 Sec </pre>	Suggested Transfer Density Purge Time Value = 10 seconds
<b>20</b>	<b>INPUT FAST STABILIZATION TIME</b>		
<b>a)</b>	Move cursor to FstStabTime line: (If cursor is on FstStabTime line, go to Step 20b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label HydroPurge     2 Sec TrnDenPurge    10 Sec FstStabTime    15 Sec </pre>	
<b>b)</b>	Enter FstStabTime Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label HydroPurge     2 Sec TrnDenPurge    10 Sec FstStabTime    15 Sec </pre>	Suggested Fast Stabilization Time Value = 15 seconds
			

**Table 5-12 Unit Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>21</b>	<b>INPUT ATMOSPHERIC PRESSURE</b>		
<b>a)</b>	Move cursor to Atm Press line: (If cursor is on Atm Press line, go to Step 21b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Unit Label TrnDenPurge  10 Sec FstStabTime  15 Sec Atm Press    14.7 PSI           </pre>	
<b>b)</b>	Enter Atm Press Value: • <b>Enter value</b> (digits only) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Unit Label TrnDenPurge  10 Sec FstStabTime  15 Sec Atm Press    14.7 PSI           </pre>	
<b>22</b>	When all Unit Setup values have been entered, <b>Press [esc] key</b> to return to the Main Menu.		



## 5-11 TANK SELECTION/LABEL

This procedure is used to select which TANK, connected to the currently selected TCU, will be active and to assign the selected TANK an alphanumeric label (up to 10 characters).

### Tank Numbers

Tank numbers are automatically assigned by the system. The tank number is the order in which the particular TANK was configured.

### Tank selection

The Tank Number can be changed from Tank Page only.

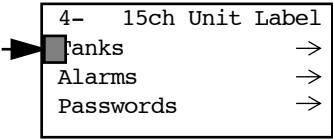
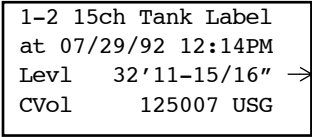
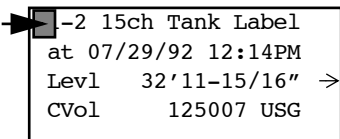
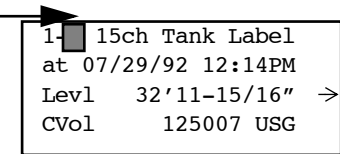
### Tank Labels

A Tank Label can only be entered locally or via Series 3500 PC Software, it cannot be entered from another TCU on the network. A user must be logged in (TCU “unlocked”) to enter a label.

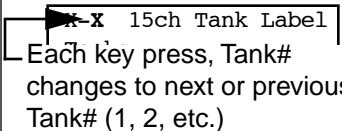
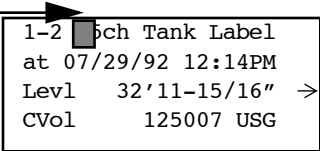
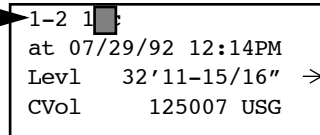
### Network Access

Remote TCU (and associated tanks) access is limited to View Only mode. No TCU settings can be changed from a remote TCU. To access a remote TCU to view tank settings, the local TCU's Unit Number must be set to the TCU controlling the desired tank.

**Table 5-13 Tank Selection/Label Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key</b>		
2	Go to TANKS Page: (If display is on the Tanks Page, go to Step 3) <b>Press [enter] key.</b>		
3	<b>TANK SELECTION</b> (Must be on Tanks Page)		
a)	Move cursor to the top line: <b>Press [tank] key.</b>		The [tank] key can be pressed from any line of a page where the unit number is accessible.  When the [tank] key is pressed twice (2X) the local TCU becomes the active unit.
b)	If desired tank # is currently displayed <u>and no label is to be entered</u> , Press [esc] key to return cursor to previous position.).		
c)	Move cursor to tank number: <b>Press [next] key</b>		

**Table 5-13 Tank Selection/Label Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>3</b>	<b>TANK SELECTION (continued)</b>		
<b>d)</b>	Select TANK Number: <b>Press UP or DOWN Arrow keys</b> until desired Tank Number is displayed.	 <p>Each key press, Tank# changes to next or previous Tank# (1, 2, etc.)</p>	Only tanks connected to the active TCU will be displayed.
<b>4</b>	<b>ENTER TANK LABEL (Must be on Tank Page, with user logged in)</b>		
<b>a)</b>	With cursor at tank number position, move cursor to Label position: <b>Press [next] key</b>		
<b>b)</b>	Enter Label (1-character at a time): <b>For Number, (.), (-) and (/) keys</b> , press appropriate key. <b>Then, press [next] key</b> to move cursor to next character.  <b>Letter/Punctuation — press UP or DOWN Arrow key</b> , until desired character is displayed. <b>Then, Press [next] key</b> to move cursor to next character.		Unit Label can be up to 10 characters long.
<b>c)</b>	<b>Repeat Step 4b</b> for each label character to be entered.		
	Once label entry is started, <b>to cancel entry, Press [esc] key</b> to return cursor to position prior to Step 1 of this procedure.		
<b>5</b>	Accept currently displayed Tank Number and Label: <b>Press [enter] key.</b>	Accepts Tank# and Label entry.	Cursor returns to position prior to Step 1 of this procedure.

## 5-12 TANK VALUES CONFIGURATION

The Tank Page is used to input tank alarm setpoints, default values (temperature and density), probe measurements, volume correction factors, tank expansion factor, safe fill, N2 compensation, probe temperature compensation, floating pan density compensation, transfer start/stop parameters, and strapping table information, as shown in Table 5-14.

**Table 5-14 Tank Page Inputs**

PROCEDURE	TABLE	PAGE
Level Alarm Setpoints	5-15	5-32
Volume Alarm Setpoints	5-16	5-34
Temperature Defaults and Alarm Setpoints	5-17	5-36
Density Defaults and Alarm Setpoints	5-18	5-38
Mass Alarm Setpoints	5-19	5-40
Water Defaults and Alarm Setpoints	5-20	5-42
Tank Setup (See Note1)	5-21	5-44

### NOTE 1

The Tank Setup Page will appear as a selection in the Tank Page, if any selection **other than 'Display Unit'** was chosen for tank type in the Unit Setup (Tank Types) Page. See Page 5-15 for details.

### NOTE 2

Tank Page 'Transfer' and 'Leak/Theft' selections are covered in Section 6 — Normal Operation.

### Multiple Tank Configurations

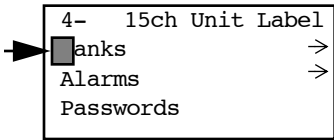
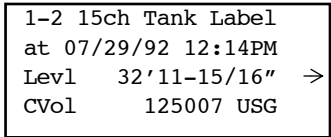
When more than (1) tank is connected to a single TCU, the Tank Values Configuration procedures must be performed for each tank. Another tank may be selected using the Tank Selection Procedure (Table 5-13, Page 5-30).

Calibration and verification procedures can be performed as each tank is configured or after all tanks are configured for a single TCU.

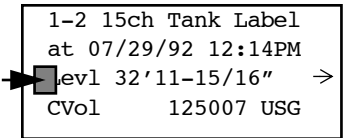
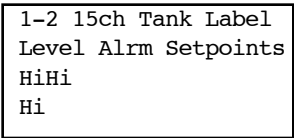
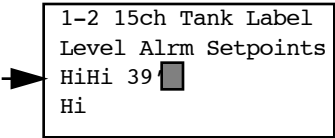
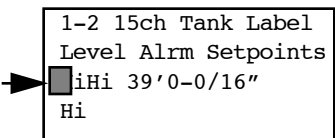
#### 5-12.1 Level Alarm Points

Procedures for setting Level Alarm Setpoints are given in Table 5-15.

**Table 5-15 Level Alarm Points Procedure**

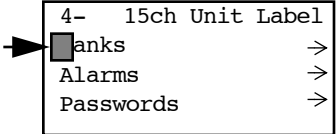
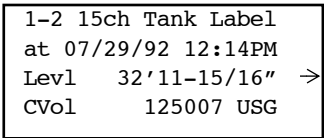
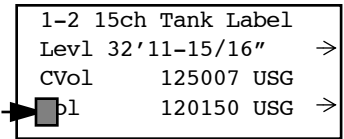
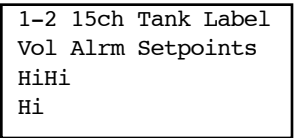
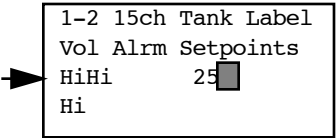

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		

**Table 5-15 Level Alarm Points Procedure (Cont.)**

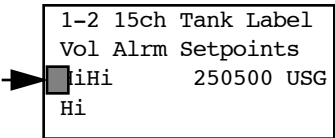
STEP	ACTION	RESULT	NOTES
3	Move cursor to LEVEL line: (If cursor is on Level line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to LEVEL Page: <b>Press [enter] key.</b>		
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b> in Meters  <b>NOTE</b> For values in feet/inches w/frac- tions: Enter feet, Press [next] key; Enter whole-number inches, Press [next] key; then, Enter fraction numerator.		Alarm value must be entered in units set in Unit Setup Page.
	<b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.		
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Level Alarm point to be entered. Note: There are (4) alarm setpoints: HiHi, Hi, LoLo, and Lo.		
8	When all desired Level Alarms are set, <b>Press [esc] key</b> to return to the Tank Page.		

## 5-12.2 Volume (Vol) Alarm Points

**Table 5-16 Volume Alarm Points Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		
3	Move cursor to Vol line: (If cursor is on Vol line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to Vol Page: <b>Press [enter] key.</b>		
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b>		Alarm value must be entered in units set in Unit Setup Page.
	<b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.		

**Table 5-16 Volume Alarm Points Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Volume (Vol) Alarm point to be entered. Note: There are (4) alarm setpoints: HiHi, Hi, LoLo, and Lo.		
8	When all desired Volume Alarms are set, <b>Press [esc] key</b> to return to the Tank Page.		

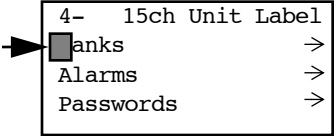
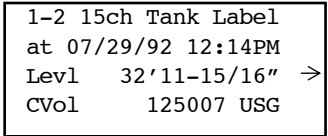
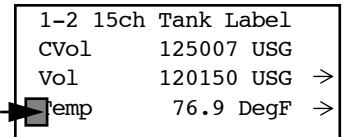
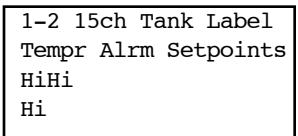
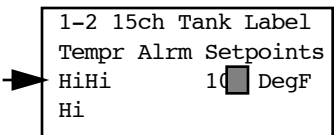

### 5-12.3 Temperature (Temp) Defaults and Alarm Points

The Temperature defaults should be the average expected temperature.

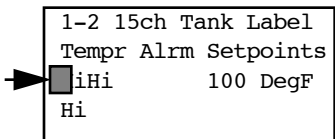
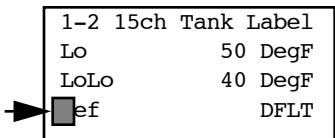
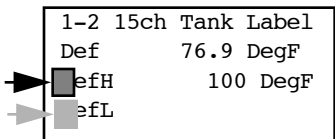
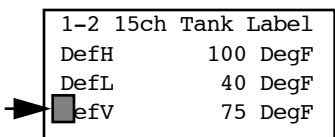
Default Modes:

- DFLT - default value used if temp. exceeds set limits
- LAST - uses last valid temp. measurement (normal mode)
- ON - uses default value in all cases
- OFF - default value is never used

**Table 5-17 Temperature Alarm Points Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		
3	Move cursor to Temp line: (If cursor is on Temp line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to Temp Page: <b>Press [enter] key.</b>		
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b>		Alarm value must be entered in units set in Unit Setup Page.
	<b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.		

**Table 5-17 Temperature Alarm Points Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Temperature (Temp) Alarm point to be entered. Note: (4) alarm setpoints, HiHi, Hi, LoLo, and Lo.		
8	Select DEFAULT MODE: • <b>Move cursor to Def line</b> • <b>Press [next] key</b> to select mode. • <b>Press [enter] key</b> to accept		Default Modes: • DFLT • Last (normal mode) • On • Off
9	Enter DEFAULT LIMITS: • <b>Move cursor to DefH line</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept  • <b>Move cursor to DefL line</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept		Default temperature values are used if the measured values exceed default limits.  • DefH and DefL are default limits • DefV is default value • Def is default MODE.
10	Enter DEFAULT VALUE: • <b>Move cursor to DefV</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept		
11	When all values are set, <b>Press [esc] key</b> to return to the Tank Page.		



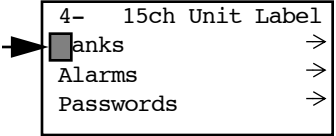
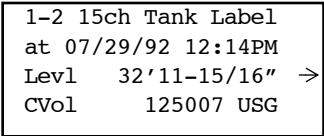
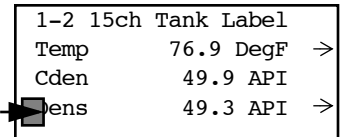
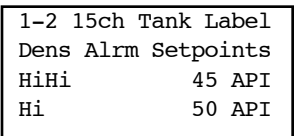
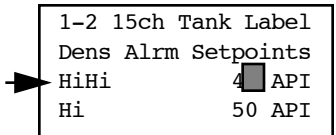

### 5-12.4 Density (Dens) Defaults and Alarm Points

The default density should be the normal expected density.

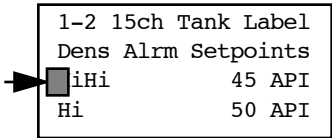
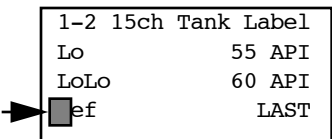
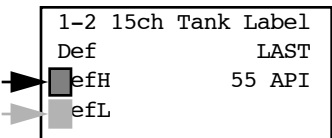
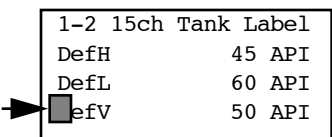
Default Modes:

- DFLT - default value used if density exceeds set limits
- LAST - uses last valid density measurement (normal mode)
- ON - uses default value in all cases
- OFF - default value is never used

**Table 5-18 Density Alarm Points Procedure**

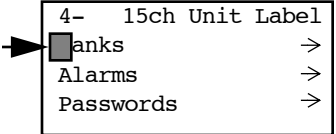
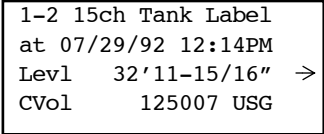
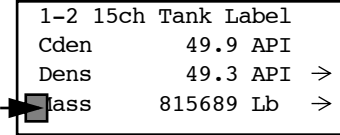
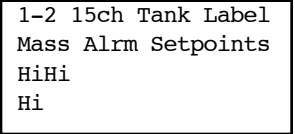
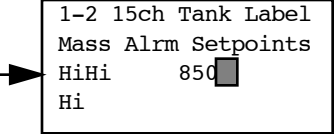

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		
3	Move cursor to Dens line: (If cursor is on Dens line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to Dens Page: <b>Press [enter] key.</b>		In API, the lower the API the higher the density. Therefore, lower API values are higher setpoints.
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b>		Alarm value must be entered in units set in Unit Setup Page.
	<b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.		

**Table 5-18 Density Alarm Points Procedure (Cont.)**

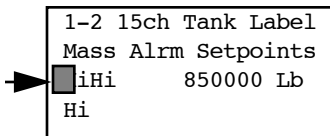
STEP	ACTION	RESULT	NOTES
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Density (Dens) Alarm point to be entered. Note: There are (4) alarm setpoints, HiHi, Hi, LoLo, and Lo.		
8	Select DEFAULT MODE: • <b>Move cursor to Def line</b> • <b>Press [next] key</b> to select mode. • <b>Press [enter] key</b> to accept		Default Modes: • DFLT • Last (normal mode) • On • Off
9	Enter DEFAULT LIMITS: • <b>Move cursor to DefH line</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept <hr/> • <b>Move cursor to DefL line</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept		Default density values are used if the measured values exceed default limits.  • DefH and DefL are default limits • DefV is default value • Def is default MODE.
10	Enter DEFAULT VALUE: • <b>Move cursor to DefV line</b> • <b>Enter (digits)</b> • <b>Press [enter] key</b> to accept		
11	When all desired Density Alarms are set, <b>Press [esc] key</b> to return to the Tank Page.		

## 5-12.5 Mass Alarm Points

**Table 5-19 Mass Alarm Points Procedure**

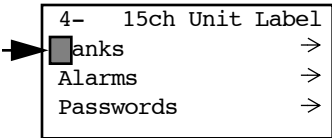
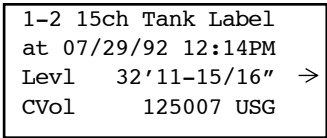
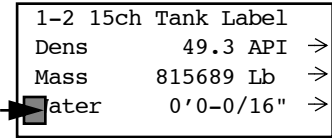
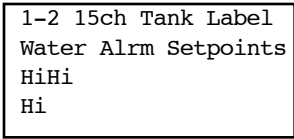
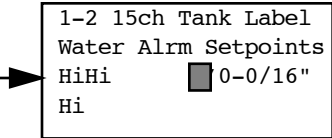

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		
3	Move cursor to Mass line: (If cursor is on Mass line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to Mass Page: <b>Press [enter] key.</b>		
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b>		Alarm value must be entered in units set in Unit Setup Page.
	<b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.		

**Table 5-19 Mass Alarm Points Procedure (Cont.)**

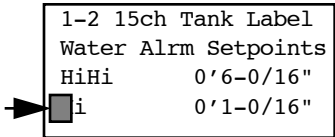
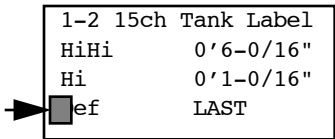
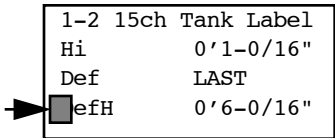
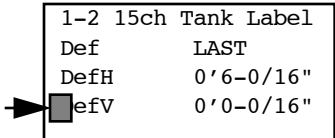
STEP	ACTION	RESULT	NOTES
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Mass Alarm point to be entered. Note: There are (4) alarm setpoints: HiHi, Hi, LoLo, and Lo.		
8	When all desired Mass Alarms are set, <b>Press [esc] key</b> to return to the Tank Page.		

## 5-12.6 Water Defaults and Alarm Points

**Table 5-20 Water Alarm Points Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to TANKS Page: <b>Press [enter] key.</b>		
3	Move cursor to Water line: (If cursor is on Water line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to Water Page: <b>Press [enter] key.</b>		The Water page has only 2 alarm setpoints.
5	Enter ALARM VALUES: • <b>Move cursor to desired alarm line</b> • <b>Enter (digits)</b> in Meters  <b>NOTE</b> For values in feet/inches w/frac-tions: Enter feet, Press [next] key; Enter whole-number inches, Press [next] key; then, Enter fraction numerator.		Alarm value must be entered in units set in Unit Setup Page.
 <b>To delete/disable alarm</b> — Enter a minus sign (-) key as first digit of setpoint.			

**Table 5-20 Water Alarm Points Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
6	When all digits have been entered, <b>Press [enter] key</b> to accept.		
7	<b>Repeat Steps 5 and 6</b> for each Water Alarm point to be entered. Note: There are (2) alarm setpoints: HiHi, and Hi.		
8	Select DEFAULT MODE • <b>Move cursor to Def line</b> • <b>Press [next] key</b> to select mode • <b>Press [enter] key</b> to accept		Default Modes: • DFLT • LAST (normal mode) • ON • OFF
9	Enter DEFAULT LIMITS: • <b>Move cursor to DefH line</b> • <b>Enter (digits)</b> in Meters • <b>Press [enter] key</b> to accept <b>NOTE</b> For values in feet/inches w/frac- tions: Enter feet, Press [next] key; Enter whole-number inches, Press [next] key; Enter fraction numerator; then, Press [enter] key to accept.		
10	Enter DEFAULT VALUE: • <b>Move cursor to DefV line</b> • <b>Enter (digits)</b> in Meters • <b>Press [enter] key</b> to accept <b>NOTE</b> For values in feet/inches w/frac- tions: Enter feet, Press [next] key; Enter whole-number inches, Press [next] key; Enter fraction numerator; then, Press [enter] key to accept.		Default values are used if the measured values exceed default limits.  • DefH is default limit • DefV is default value • Def is default MODE.
11	When all desired Water Alarms are set, <b>Press [esc] key</b> to return to the Tank Page.		

## 5-12.7 Tank Setup

The Tank Setup Page is used to enter probe measurements, volume correction factor, tank expansion factor, safe fills, N2 compensation, probe temperature compensation, floating pan density compensation, transfer start/stop parameters, and gives access to the Strapping Table Page.

### Probe Measurements

#### **NOTICE**

Probe measurements are etched onto the probe weight and also listed on a paper tag attached to the probe.

- **R to Bot**  
Factory measurement of the position of the 'R' probe to the bottom of the probe weight.
- **N to Bot**  
Factory measurement of the position of the 'N' probe to the bottom of the probe weight.
- **W to Bot**  
Factory measurement of the position of the 'W' probe to the bottom of the probe weight. 'W' probes are only supplied with Tall Tank Probes.
- **H to Bot**  
Factory measurement of the position of the 'H' probe to the bottom of the probe weight. 'H' probes are only supplied on tanks measuring water.

### Other Tank Values

- **Offset**  
Calibration value used to provide zero adjustment of the level measurement. Value in inches.
- **LFact R**  
The Level Factor For R calibration value for level span adjustment when the density is measured from 'H' and 'R' tubes and the level is below the 'N' tube. This value is dimensionless.
- **DFact R**  
Density Factor For R calibration value for level span adjustment when the density is measured from 'H' and 'R' tubes and the level is below the 'N' tube. This value is dimensionless.
- **LFact N**  
Level Factor For N calibration value for level span adjustment when the density is measured from the 'N' and 'R' tubes.
- **DFact N**  
Density Factor For N calibration value for density adjustment when the density is measured from the 'N' and 'R' tubes.
- **LFact W**  
Level Factor For W calibration value for level adjustment when the density is measured from the 'R' and 'W' tubes.
- **DFact W**  
Density Factor For W calibration value for density adjustment when the density is measured from the 'R' and 'W' tubes.
- **HProbeEnbl**  
'H' Probe Enabled. To enable the measurement of water from the 'H' tube. Level in tank must be above the 'N' tube. Selection is Yes or No.
- **HtoRDensEnbl**  
H to R Density Enabled. To enable the measurement of density from the 'H' and 'R' tubes when the level is below the 'N' tube. Selection is Yes or No.
- **Water SG**  
Water Specific Gravity. The specific gravity of the water used in the calculation of the water level measurement. Value in s.g..
- **ASTM 1250**  
Volume Correction per ASTM 1250. To enable volume correction per ASTM 1250 tables to 60°F (15°C). Selection is Yes or No.
- **F Exp**  
Fluid Expansion Factor. Compensation value for volume correction when ASTM 1250 is not selected. Value is amount of change per temperature unit.
- **T Exp**  
Tank Expansion Factor. Value used to compensate for changes in tank construction due to temperature changes. Value is amount of change per temperature unit.
- **S Fill**  
Safe Fill Point. The point in the tank that represents zero ullage. Value in level units.
- **N2 Comp**  
Nitrogen Compensation. To enable compensation for level correction due to the weight of the nitrogen in the sensing lines at the ambient temperature measured by the system. Selection is Yes or No.

- **T to Bot**  
'T' tube to bottom of probe weight used for nitrogen compensation. Value in inches.
- **U to Bot**  
TCU unit to bottom of probe weight used for nitrogen compensation. Value in inches.
- **Probe T Comp**  
Probe temperature compensation. To enable compensation of measurement probe dimension affected by fuel temperature. Selection is Yes or No.
- **Base T Comp**  
Base Temperature. The temperature at which the probe dimensions are based. Value in temperature units.
- **Pan D Comp**  
Floating Pan Density Compensation. To enable compensation for a density value other than the value used by the tank manufacturer for the strapping tables. Selection is Yes or No.
- **Start**  
Starting Point at which the pan compensation will take effect. Value in inches.
- **Adj Vol**  
Adjusted Volume. The amount to adjust the strapping table volume for the different density fluid lifting the pan. Value in volume units.
- **Ref Den**  
Reference Density. The density used by the strapping table manufacturer for floating pan adjustments. Value in API.
- **TrnDen HT**  
Transfer Density Height. The interval value at which the density will be measured while in Transfer Mode. Value in inches.
- **TrnStrtTries**  
Transfer Start Tries. The number of times the corrected volume must exceed the TrnCVol value to enter the automatic transfer mode. Value is an integer.
- **TrnCVol**  
Transfer Start Corrected Volume. The value used as a setpoint to activate the automatic transfer mode. Value in units of volume.
- **TrnStrtSamps**  
Transfer Start Samples. The value for the number of previous readings averaged. Value is an integer.
- **TrnStopTries**  
Transfer Stop Tries. The value for the number of tries the transfer flowrate must drop below to stop the transfer. Value is an integer.
- **Trn Rate**  
Transfer Stop Flowrate. The value used as a setpoint for the flowrate to end the transfer mode. Value in volume units per minute.
- **TrnStopSamps**  
Transfer Stop Samples. The value for the number of previous readings averaged. Value is an integer.
- **Strapping Table**  
A table of level vs volume. Value in units of level and volume.
- **Product**  
Fluid product. An identification of the fluid product used for product group in the Series 3500 PC program.



The following values are input from the Tank Setup Page:

**Table 5-21 Tank Setup Input Steps**

Unit Value	Step #
Probe Measurements	
R to Bot	2
N to Bot	2
W to Bot	2
H to Bot	2
Other Tank Values	
Offset, LFactR, DFactR, LFactN, DFactN, LFactW, and DFactW are correction factors — these will be addressed in para. 5-13 (Calibration). Default = 1.0000	
H Probe Enable [selection]	3
H to R Density Enable [selection]	4
Water Specific Gravity (WaterSG)	5
Volume Correction Factor either ASTM 1250 factors or manually input factors	6
Fluid Expansion Factor (ASTM 1250 set to NO only)	7
Tank Expansion Factor, Safe Fill, N2 Comp, TtoBot, UtoBot, ProbeT Comp, BaseT, PanDComp, Start, AdjVol, RefDens, TrnDenHT, TrnStartTries, TrnCVol, TrnStartSamps, TrnStop- Tries, TrnRate, TrnStopSamps	8
Strapping Table	
Strapping Table Values	9
Tank Product	
Product Label (can only be entered via Series 3500 PC Software)	

Table 5-23 lists the steps for inputting Table 5-21 values. These values are listed in the order given in the Tank Setup Page. Initial setup procedures follow Table 5-21's order. However, the table lists the step# involved for each value — for reference when changing specific values in the future.

**Table 5-22 Probe Meas. vs Tank Type**

Tank Type	R to Bottom	N to Bottom	W to Bottom	H to Bottom
2 Tall + Water	X	X	X	X
3 Short + Water	X	X		X
4 Short - Water	X	X		

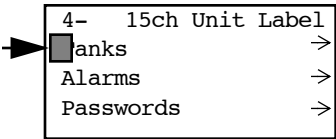
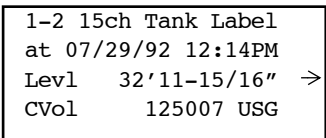
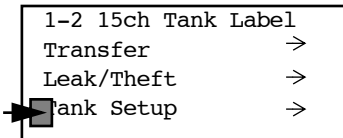
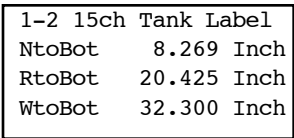
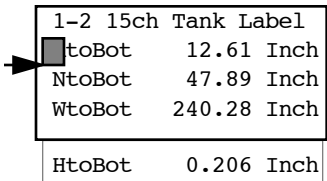
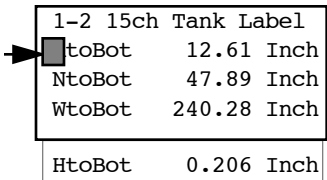

### Multiple Tank Configurations

When more than (1) tank is connected to a single TCU, the Tank Values Configuration procedures must be performed for each tank. Another tank may be selected using the Tank Selection Procedure, Table 5-13.

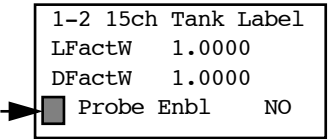
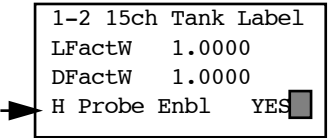
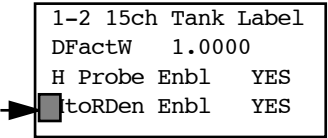
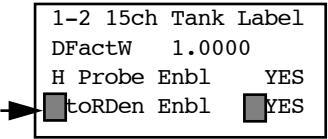
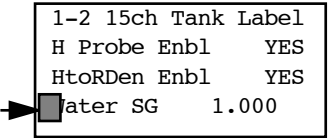

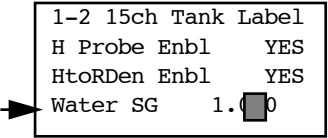
### Strapping Table Data

Strapping table data must be entered on the TCU that contains the strapping table to be changed. A remote TCU's strapping table cannot be accessed over the network, except from a PC (connected to the network) that is running the Series 3500 PC-software.

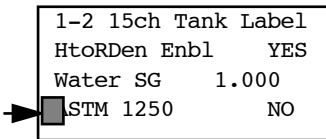
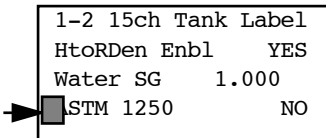
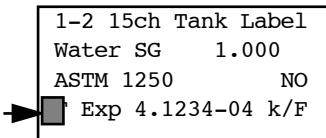

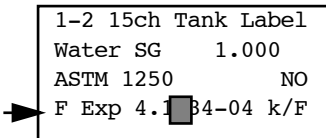
**Table 5-23 Tank Setup Values Input Procedure**

STEP	ACTION	RESULT	NOTES
<b>1</b>	<b>GO TO TANK SETUP PAGE</b>		
<b>a)</b>	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 1b) <b>Press UP Arrow key</b>	 <pre> 4- 15ch Unit Label Tanks      -&gt; Alarms     -&gt; Passwords  -&gt;           </pre>	
<b>b)</b>	Go to TANKS Page: (If display is on the Tanks Page, go to Step 1c) <b>Press [enter] key.</b>	 <pre> 1-2 15ch Tank Label at 07/29/92 12:14PM Levl  32'11-15/16" -&gt; CVol   125007 USG           </pre>	
<b>c)</b>	Move cursor to Tank Setup line: <b>Press DOWN Arrow key.</b> to scroll display until Tank Setup is displayed.	 <pre> 1-2 15ch Tank Label Transfer      -&gt; Leak/Theft    -&gt; Tank Setup    -&gt;           </pre>	
<b>d)</b>	Go to TANK SETUP Page: <b>Press [enter] key.</b>	 <pre> 1-2 15ch Tank Label NtoBot   8.269 Inch RtoBot   20.425 Inch WtoBot   32.300 Inch           </pre>	
<b>2</b>	<b>INPUT PROBE MEASUREMENTS (R to Bot, N to Bot, WtoBot, HtoBot)</b>		
<b>a)</b>	Move cursor to probe measurement line to be input: (If cursor is on desired line, go to Step 2b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label NtoBot   12.61 Inch NtoBot   47.89 Inch WtoBot   240.28 Inch HtoBot    0.206 Inch           </pre>	
<b>b)</b>	Enter Measurement Value: • <b>Enter value</b> (digits + decimal point) <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label NtoBot   12.61 Inch NtoBot   47.89 Inch WtoBot   240.28 Inch HtoBot    0.206 Inch           </pre>	
 <b>c)</b>	<b>Repeat Steps 2a and 2b</b> for each basic probe measurement to be entered.		

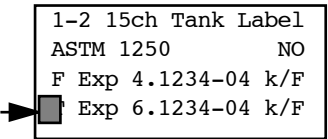
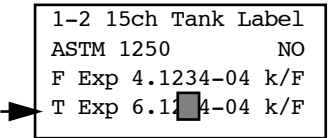
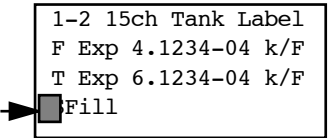
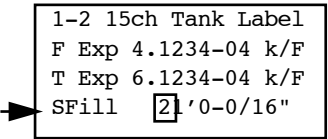
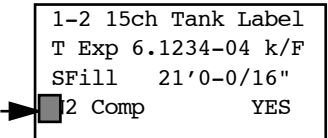
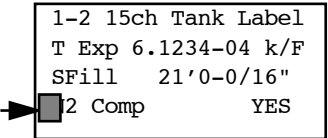
**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>3</b>	<b>SELECT H-PROBE ENABLE</b> (Enabled or not enabled)		
<b>a)</b>	Move cursor to H Probe Enbl line: (If cursor is on line, go to Step 3b): <b>Press UP or DOWN Arrow key</b>	 <pre> 1-2 15ch Tank Label LFactW  1.0000 DFactW  1.0000 H Probe Enbl  NO           </pre>	
<b>b)</b>	Select STATUS (YES or NO): • <b>Press [next] key</b> • When desired choice is displayed, <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label LFactW  1.0000 DFactW  1.0000 H Probe Enbl  YES           </pre>	
<b>4</b>	<b>SELECT H TO R DENSITY ENABLE</b> (Enabled or not enabled)		
<b>a)</b>	Move cursor to HtoRDenEnbl line: (If cursor is on desired line, go to Step 4b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label DFactW  1.0000 H Probe Enbl  YES HtoRDen Enbl  YES           </pre>	
<b>b)</b>	Select STATUS (YES or NO): • <b>Press [next] key</b> • When desired choice is displayed, <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label DFactW  1.0000 H Probe Enbl  YES HtoRDen Enbl  YES           </pre>	
<b>5</b>	<b>INPUT WATER SPECIFIC GRAVITY VALUE</b> (Water SG)		
<b>a)</b>	Move cursor to WATER SG line: (If cursor is on desired line, go to Step 5b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label H Probe Enbl  YES HtoRDen Enbl  YES Water SG      1.000           </pre>	WaterSG is the specific gravity of sampling.
<b>b)</b> 	Enter WATER SG Value: • <b>Enter Value</b> (digits + decimal point) • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label H Probe Enbl  YES HtoRDen Enbl  YES Water SG      1.000           </pre>	

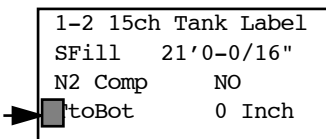
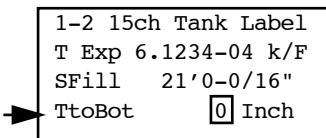
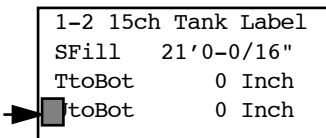
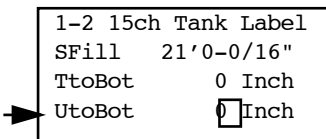
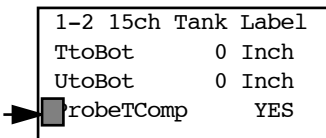
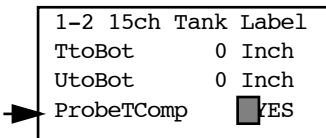
**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>6</b>	<b>SELECT VOLUME CORRECTION METHOD</b> (ASTM 1250 or Manual Input Values)		
<b>a)</b>	Move cursor to ASTM 1250 line (If cursor is on line, go to Step 6b): <b>Press UP or DOWN Arrow key</b>	 <pre> 1-2 15ch Tank Label HtoRDen Enbl    YES Water SG        1.000 ASTM 1250        NO           </pre>	
<b>b)</b>	Select STATUS (YES or NO): • <b>Press [next] key</b> • When desired choice is displayed, <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label HtoRDen Enbl    YES Water SG        1.000 ASTM 1250        NO           </pre>	
<b>7</b>	<b>INPUT FLUID EXPANSION FACTOR</b> (F Exp) <b>Note:</b> If Volume Correction Method is set to ASTM 1250, go to Step 7.		
<b>a)</b>	Move cursor to F EXP line: (If cursor is on desired line, go to Step 7b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label Water SG        1.000 ASTM 1250        NO F Exp 4.1234-04 k/F           </pre>	<b>This parameter is NOT entered</b> if Volume Correction Method (Step 5) is <b>set to ASTM 1250</b> .
<b>b)</b> 	Enter F EXP Value: • <b>Enter Base Digits</b> • <b>Press [up arrow]</b> (exponent key) • <b>Enter exponent digits</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label Water SG        1.000 ASTM 1250        NO F Exp 4.1234-04 k/F           </pre>	

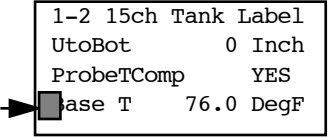
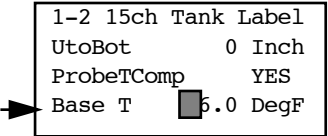
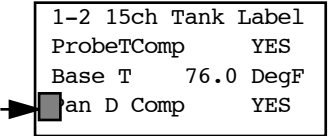
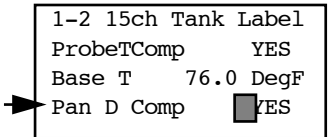
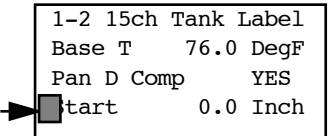
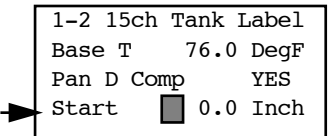

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>8</b>	<b>INPUT TANK EXPANSION FACTOR (T Exp)</b>		
<b>a)</b>	Move cursor to T EXP line: (If cursor is on desired line, go to Step 8b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label ASTM 1250          NO F Exp 4.1234-04 k/F T Exp 6.1234-04 k/F </pre>	
<b>b)</b>	Enter T EXP Value: <ul style="list-style-type: none"> <li>• <b>Enter Base Digits</b></li> <li>• <b>Press [up arrow]</b> (exponent key)</li> <li>• <b>Enter exponent digits</b></li> <li>• <b>Press [enter]</b> key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label ASTM 1250          NO F Exp 4.1234-04 k/F T Exp 6.1234-04 k/F </pre>	
<b>9</b>	<b>INPUT SAFE FILL LEVEL (SFill)</b>		
<b>a)</b>	Move cursor to SFill line: (If cursor is on desired line, go to Step 9b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label F Exp 4.1234-04 k/F T Exp 6.1234-04 k/F SFill </pre>	Note: If SFill is blank, ullage is calculated using the highest strapping table value as its zero point.
<b>b)</b>	Enter SFill Value: <ul style="list-style-type: none"> <li>• <b>Enter digits</b></li> <li>• <b>Press [next]</b></li> <li>• <b>Enter fraction (numerator) digits</b></li> <li>• <b>Press [enter]</b> key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label F Exp 4.1234-04 k/F T Exp 6.1234-04 k/F SFill 21'0-0/16" </pre>	Fraction denominator is automatically set per level measurement units selected in Unit Setup Page.
<b>10</b>	<b>SELECT NITROGEN COMPENSATION STATUS (N2 Comp)</b>		
<b>a)</b>	Move cursor to N2 Comp line (If cursor is on line, go to Step 10b): <b>Press UP or DOWN Arrow key</b>	 <pre> 1-2 15ch Tank Label T Exp 6.1234-04 k/F SFill 21'0-0/16" N2 Comp          YES </pre>	
<b>b)</b>	Select STATUS (YES or NO): <ul style="list-style-type: none"> <li>• <b>Press [next] key</b></li> <li>• When desired choice is displayed, <b>Press [enter]</b> key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label T Exp 6.1234-04 k/F SFill 21'0-0/16" N2 Comp          YES </pre>	

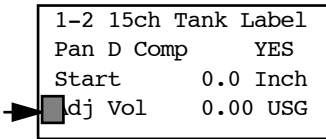
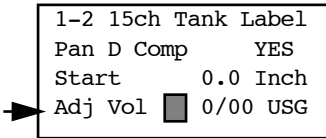
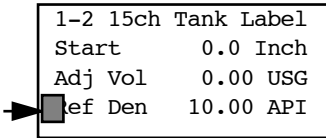
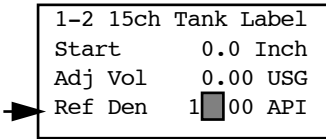
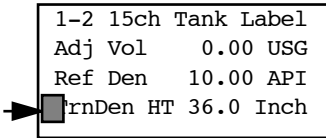
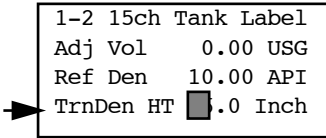

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>11</b>	<b>INPUT T-LINE TO BOTTOM DISTANCE (TtoBot)</b>		
<b>a)</b>	Move cursor to TtoBot line: (If cursor is on desired line, go to Step 11b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label SFill  21'0-0/16" N2 Comp    NO TtoBot    0 Inch           </pre>	
<b>b)</b>	Enter TtoBot Value: <ul style="list-style-type: none"> <li>• Enter digits</li> <li>• Press [next]</li> <li>• Enter fraction (numerator) digits</li> <li>• Press [enter] key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label T Exp 6.1234-04 k/F SFill  21'0-0/16" TtoBot    0 Inch           </pre>	
<b>12</b>	<b>INPUT TCU UNIT TO PROBE BOTTOM DISTANCE (UtoBot)</b>		
<b>a)</b>	Move cursor to UtoBot line: (If cursor is on desired line, go to Step 12b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label SFill  21'0-0/16" TtoBot    0 Inch UtoBot    0 Inch           </pre>	
<b>b)</b>	Enter UtoBot Value: <ul style="list-style-type: none"> <li>• Enter digits + decimal point</li> <li>• Press [enter] key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label SFill  21'0-0/16" TtoBot    0 Inch UtoBot    0 Inch           </pre>	
<b>13</b>	<b>SELECT PROBE TEMPERATURE COMPENSATION STATUS (ProbeTComp)</b>		
<b>a)</b>	Move cursor to ProbeTComp line: (If cursor is on desired line, go to Step 13b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label TtoBot    0 Inch UtoBot    0 Inch ProbeTComp YES           </pre>	
<b>b)</b>	Enter ProbeTComp Status: <ul style="list-style-type: none"> <li>• Press [next] key</li> <li>• When desired choice is displayed, Press [enter] key to accept</li> </ul>	 <pre> 1-2 15ch Tank Label TtoBot    0 Inch UtoBot    0 Inch ProbeTComp YES           </pre>	

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>14</b>	<b>ENTER BASE TEMPERATURE (Base T)</b>		
<b>a)</b>	Move cursor to Base T line: (If cursor is on desired line, go to Step 14b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label UtoBot      0 Inch ProbeTComp  YES Base T      76.0 DegF           </pre>	
<b>b)</b>	Enter Base T Value: • <b>Enter digits + decimal point</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label UtoBot      0 Inch ProbeTComp  YES Base T      6.0 DegF           </pre>	
<b>15</b>	<b>SELECT FLOATING PAN DENSITY COMPENSATION STATUS (Pan D Comp)</b>		
<b>a)</b>	Move cursor to Base T line: (If cursor is on desired line, go to Step 15b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label ProbeTComp  YES Base T      76.0 DegF Pan D Comp  YES           </pre>	
<b>b)</b>	Select Pan D Comp Status: • <b>Press [next] key</b> • When desired choice is displayed, <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label ProbeTComp  YES Base T      76.0 DegF Pan D Comp  YES           </pre>	
<b>16</b>	<b>ENTER COMPENSATION START POINT (Start)</b>		
<b>a)</b>	Move cursor to Start line: (If cursor is on desired line, go to Step 16b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label Base T      76.0 DegF Pan D Comp  YES Start       0.0 Inch           </pre>	
<b>b)</b>	Enter Start Value: • <b>Enter digits + decimal point</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label Base T      76.0 DegF Pan D Comp  YES Start       0.0 Inch           </pre>	
			

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

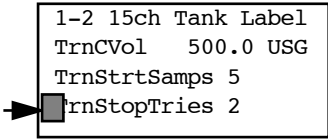
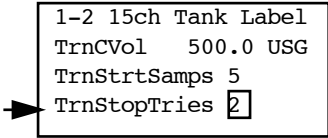
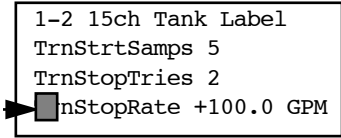
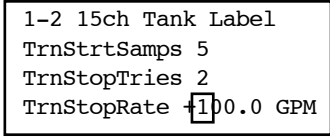
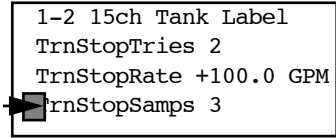
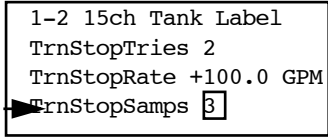
STEP	ACTION	RESULT	NOTES
<b>17</b>	<b>ENTER ADJUSTMENT VOLUME (Adj Vol)</b>		
<b>a)</b>	Move cursor to Adj Vol line: (If cursor is on desired line, go to Step 17b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter Adj Vol Value: • <b>Enter digits + decimal point</b> • <b>Press [enter] key</b> to accept		
<b>18</b>	<b>ENTER REFERENCE DENSITY (Ref Den)</b>		
<b>a)</b>	Move cursor to Ref Den line: (If cursor is on desired line, go to Step 18b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter Ref Den Value: • <b>Enter digits + decimal point</b> • <b>Press [enter] key</b> to accept		
<b>19</b>	<b>ENTER TRANSFER DENSITY HEIGHT INTERVAL (TrnDen HT)</b>		
<b>a)</b>	Move cursor to TrnDen HT line: (If cursor is on desired line, go to Step 19b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Enter TrnDen HT Value: • <b>Enter digits + decimal point</b> • <b>Press [enter] key</b> to accept		
			



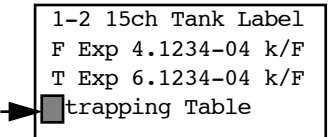
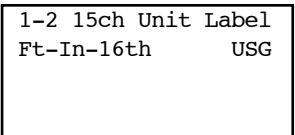

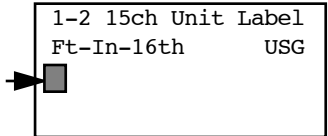
**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>20</b>	<b>ENTER TRANSFER START TRIES (TrnStrtTries)</b>		
<b>a)</b>	Move cursor to TrnStrtTries line: (If cursor is on desired line, go to Step 20b) <b>Press UP or DOWN Arrow key.</b>	<pre> 1-2 15ch Tank Label Ref Den    10.00 API TrnDen HT  36.0  Inch TrnStrtTries 2           </pre>	
<b>b)</b>	Enter TrnStrtTries Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	<pre> 1-2 15ch Tank Label Ref Den    10.00 API TrnDen HT  36.0  Inch TrnStrtTries 2           </pre>	
<b>21</b>	<b>ENTER TRANSFER START CORRECTED VOLUME (TrnCVol )</b>		
<b>a)</b>	Move cursor to TrnCVol line: (If cursor is on desired line, go to Step 21b) <b>Press UP or DOWN Arrow key.</b>	<pre> 1-2 15ch Tank Label TrnDen HT  36.0  Inch TrnStrtTries 2 TrnCVol    500.0  USG           </pre>	
<b>b)</b>	Enter TrnCVol Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	<pre> 1-2 15ch Tank Label TrnDen HT  36.0  Inch TrnStrtTries 2 TrnCVol    500.  USG           </pre>	
<b>22</b>	<b>ENTER TRANSFER START SAMPLES (TrnStrtSamps )</b>		
<b>a)</b>	Move cursor to TrnStrtSamps line: (If cursor is on desired line, go to Step 22b) <b>Press UP or DOWN Arrow key.</b>	<pre> 1-2 15ch Tank Label TrnStrtTries 2 TrnCVol    500.0  USG TrnStrtSamps 5           </pre>	
<b>b)</b>	Enter TrnStrtSamps Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	<pre> 1-2 15ch Tank Label TrnStrtTries 2 TrnCVol    500.0  USG TrnStrtSamps 5           </pre>	

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>23</b>	<b>ENTER TRANSFER STOP TRIES (TrnStopTries )</b>		
<b>a)</b>	Move cursor to TrnStopTries line: (If cursor is on desired line, go to Step 23b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label TrnCVol   500.0 USG TrnStrtSamps 5 TrnStopTries 2           </pre>	
<b>b)</b>	Enter TrnStopTries Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label TrnCVol   500.0 USG TrnStrtSamps 5 TrnStopTries 2           </pre>	
<b>24</b>	<b>ENTER TRANSFER STOP FLOWRATE (TrnStopRate)</b>		
<b>a)</b>	Move cursor to TrnStopRate line: (If cursor is on desired line, go to Step 24b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label TrnStrtSamps 5 TrnStopTries 2 TrnStopRate +100.0 GPM           </pre>	
<b>b)</b>	Enter TrnStopRate Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label TrnStrtSamps 5 TrnStopTries 2 TrnStopRate 100.0 GPM           </pre>	
<b>25</b>	<b>ENTER TRANSFER STOP SAMPLES (TrnStopSamps)</b>		
<b>a)</b>	Move cursor to TrnStopSamps line: (If cursor is on desired line, go to Step 25b) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label TrnStopTries 2 TrnStopRate +100.0 GPM TrnStopSamps 3           </pre>	
<b>b)</b>	Enter TrnStopSamps Value: • <b>Enter digits</b> • <b>Press [enter] key</b> to accept	 <pre> 1-2 15ch Tank Label TrnStopTries 2 TrnStopRate +100.0 GPM TrnStopSamps 3           </pre>	

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>26</b>	<b>INPUT STRAPPING TABLE INFORMATION (IF REQUIRED)</b> If Strapping Table data is to be entered electronically (data transfer), <b>go to Step 9.</b> If Strapping Table data is to be manually entered or modified, continue with this Step.  <p style="text-align: center;"><b>NOTICE</b></p> <p>Strapping table data cannot be entered from a remote TCU/TDU. Strapping data can only be entered from the TCU that contains the strapping table to be changed or a PC (connected to the network) running the Series 3500 PC Software. Attempts to access the strapping table from a remote unit will result in a [Not Local Unit] message being displayed.</p> <p><b>Data:</b> The TCU uses linear interpolation between strapping table points; therefore, only non-linear points need to be entered.</p> <p><b>Deleting Data:</b> Once a data line has been entered, it cannot be modified. However, a data line can be deleted and re-entered with the correct information — the system will automatically sort the data lines after entry, placing them in the correct order.</p>		
<b>a)</b>	Move cursor to Strapping Table line: (If cursor is on desired line, go to Step 26b) <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Go to STRAPPING TABLE Page: <b>• Press [enter] key</b>		Units of measure displayed are those set in the Unit Setup Page.
<b>c)</b>	<b>Move cursor to entry line</b> to be changed, using the Arrow Keys <b>or create entry line</b> — If this is initial input of strapping table data, press the <b>[enter] key</b> to create a BLANK line.  		

**Table 5-23 Tank Setup Values Input Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES																																																
26	INPUT STRAPPING TABLE INFORMATION (continued)																																																		
d)	<p>Enter DATA on line:</p> <ul style="list-style-type: none"><li>• <b>Enter first</b> tank measurement <b>value</b> (digits only)</li><li>• <b>Press [next] key</b> (Adds inch symbol and cursor goes to next field)</li><li>• <b>Enter next value</b> (digits only)</li><li>• <b>Press [next] key</b> (Adds dash)</li><li>• <b>Enter fraction numerator</b></li><li>• <b>Press [/] key</b></li><li>• <b>Enter fraction denominator</b></li><li>• <b>Press [next] key</b> to move cursor to volume field</li><li>• <b>Enter volume data</b> (digits only)</li><li>• <b>Press [enter] key</b> to accept</li></ul>	<div><div><table><tr><td>1-2</td><td>15ch</td><td>Unit</td><td>Label</td></tr><tr><td>Ft-In-16th</td><td></td><td></td><td>USG</td></tr><tr><td>00'</td><td>00-00/16"</td><td></td><td>0</td></tr><tr><td>➔ 02'</td><td>10-15/16"</td><td></td><td>10</td></tr></table></div><div>Entry Example:<table><tr><td>Key</td><td>Entry</td></tr><tr><td>[0]</td><td>0</td></tr><tr><td>[2]</td><td>02</td></tr><tr><td>[next]</td><td>02'</td></tr><tr><td>[1]</td><td>02' 1</td></tr><tr><td>[0]</td><td>02' 10</td></tr><tr><td>[next]</td><td>02' 10-</td></tr><tr><td>[1]</td><td>02' 10-1</td></tr><tr><td>[5]</td><td>02' 10-15</td></tr><tr><td>[/]</td><td>02' 10-15/</td></tr><tr><td>[1]</td><td>02' 10-15/1</td></tr><tr><td>[6]</td><td>02' 10-15/16</td></tr><tr><td>[next]</td><td>02' 10-15/16"</td></tr><tr><td>[1]</td><td>02' 10-15/16"</td></tr><tr><td>[0]</td><td>02' 10-15/16"</td></tr><tr><td>[enter]</td><td>Accepted</td></tr></table></div></div>	1-2	15ch	Unit	Label	Ft-In-16th			USG	00'	00-00/16"		0	➔ 02'	10-15/16"		10	Key	Entry	[0]	0	[2]	02	[next]	02'	[1]	02' 1	[0]	02' 10	[next]	02' 10-	[1]	02' 10-1	[5]	02' 10-15	[/]	02' 10-15/	[1]	02' 10-15/1	[6]	02' 10-15/16	[next]	02' 10-15/16"	[1]	02' 10-15/16"	[0]	02' 10-15/16"	[enter]	Accepted	<p>If an entry error is made, the line must be deleted and re-entered.</p> <p>The [-] key does not function as a delete key while entering data. The [-] key can only be used to delete an existing line.</p>
1-2	15ch	Unit	Label																																																
Ft-In-16th			USG																																																
00'	00-00/16"		0																																																
➔ 02'	10-15/16"		10																																																
Key	Entry																																																		
[0]	0																																																		
[2]	02																																																		
[next]	02'																																																		
[1]	02' 1																																																		
[0]	02' 10																																																		
[next]	02' 10-																																																		
[1]	02' 10-1																																																		
[5]	02' 10-15																																																		
[/]	02' 10-15/																																																		
[1]	02' 10-15/1																																																		
[6]	02' 10-15/16																																																		
[next]	02' 10-15/16"																																																		
[1]	02' 10-15/16"																																																		
[0]	02' 10-15/16"																																																		
[enter]	Accepted																																																		
e)	<p>To add another data line: <b>Press [enter] key</b> — creates a blank line — then, <b>Repeat Step 26(d)</b></p>																																																		
<p><b>Repeat Steps 26(d) and 26(e) until all entries are made.</b> To change an entry, perform Steps 26(c) and 26(d), as needed.</p>																																																			
	<p><b>TO DELETE a Strapping Table line:</b></p>																																																		
	<p>Move cursor to line to be deleted: <b>Press UP or DOWN Arrow key.</b></p> <p>Then,</p> <p><b>Press [-] key.</b> A cofirmation message is displayed - <b>Press [enter] key</b> to delete <b>or [esc] key</b> to exit.</p>	<div><div><table><tr><td>1-2</td><td>15ch</td><td>Unit</td><td>Label</td></tr><tr><td>Ft-In-16th</td><td></td><td></td><td>USG</td></tr><tr><td>00'</td><td>00-00/16"</td><td></td><td>0</td></tr><tr><td>➔ ■ 2'</td><td>10-15/16"</td><td></td><td>10</td></tr></table></div><div><div>Press ENTER to Delete or ESC to exit</div></div></div>	1-2	15ch	Unit	Label	Ft-In-16th			USG	00'	00-00/16"		0	➔ ■ 2'	10-15/16"		10	<p>If the [enter] key is pressed, the line is deleted and the screen returns to the strapping table page.</p> <p>If the [esc] key is pressed, the screen returns to the strapping table page.</p>																																
1-2	15ch	Unit	Label																																																
Ft-In-16th			USG																																																
00'	00-00/16"		0																																																
➔ ■ 2'	10-15/16"		10																																																
<p><b>PRODUCT LABEL</b> (at bottom of Tank Setup Page) This can only be entered using the Series 3500 PC Software. It cannot be entered via the TCU.</p>																																																			
<p><b>Configuration is now complete.</b> <b>Press [esc] key</b> to return to the Tank Page and continue to para. 5-13 - Calibration, if required, otherwise, go to para. 5-14 - Logout.</p>																																																			

## 5-13 CALIBRATION

The Series 3500 measurement probes are factory assembled and measured to provide stated system accuracy. **Periodic re-calibration is not required.**

To achieve optimum system performance, the TCU may be fine-tuned to actual physical measurements, using the calibration factors (correction values) listed in Table 5-24.

**Table 5-24 Tank Setup Values  
(Fine Tuning Calibration)**

VALUE	DESCRIPTION
Offset	Zero Adjustments (all level readings are adjusted upward or downward by the offset amount).
LFactR & DFactR	Level and Density adjustment factors for levels below the 'N' tube, when HtoR density measurement is enabled.
LFactN & DFactN	Level and Density adjustment factors for levels between the 'N' and 'W' tubes (or below 'N' if HtoR density is not enabled).
LFactW & DFactW	Level and Density adjustment factors for levels above the 'W' tube (Tall Tanks Only).

### NOTICE

User must be logged-in at Level 2 to perform a calibration.

### 5-13.1 Single Point Calibration Procedure

If it is not feasible to change the tank level for calibration purposes, use the following procedure (If tank level can be changed, use the multi-point procedure in para. 5-13.2).

1. Perform a manual level measurement.
2. Perform a manual density measurement and correct the reading to standard temperature.

3. Adjust the Offset Value to provide a level reading that agrees with the manual measurement at the current level. *Typical Offset value is +0.25 inch.*
  - a. From Main Menu Page, select Tanks.
  - b. From Tanks Page, select Tank Setup Page.
  - c. In Tank Setup Page, move cursor to Offset line.
  - d. Enter Offset value using number and decimal point keys. Then, Press [enter] key to accept.
4. Adjust all three density adjustment factors (DFactR, DFactN, DFactW) to provide a corrected density measurement that agrees with the manual sample. A Dfact greater than one increases the displayed density (reduces the API), while a Dfact less than one decreases the displayed density (increasing the API). A full measurement must be taken each time the density factors are changed.
  - a. In Tanks Setup Page (Step 3), move cursor to DFact R line and enter correction amount, using the number and decimal keys. Then, Press [enter] key to accept.
  - b. Move cursor to DFactN line and enter correction amount, using the number and decimal keys. Then, Press [enter] key to accept.
  - c. Move cursor to DFact W line and enter correction amount, using the number and decimal keys. Then, Press [enter] key to accept.

The formula shown in Figure 5-1 can be used to determine the new density factor (values must be converted to specific gravity) for single point calibration.

$$\text{New Dfact} = \frac{\text{Sample CorrDen} - \text{Displayed CorrDen}}{\text{Sample CorrDen}} + \text{Old Dfact}$$

**Figure 5-1 New Density Factor Calculation for Single Point Calibration**

### 5-13.2 Multiple Point Calibration Procedure

If it is feasible to change the tank level for calibration purposes, use the following procedure.

#### NOTICE

This may be done over a period of time, during normal tank operation.

#### NOTICE

User must be logged-in at Level 2 to perform a calibration.

1. Perform manual level measurements and record TCU displayed measurements near the following fill levels (values are approx.):
  - 6 inches below the 'N' tube
  - 6 inches above the 'N' tube
  - 6 inches below the 'W' tube (Tall Tanks Only)
  - 6 inches above the 'W' tube (Tall Tanks Only)
  - Near Full
2. Adjust the **Offset** value to provide correct level readings for the measurements approx. 6 inches above the 'N' tube (or 'W' tube).  
*Typical Offset value is +0.25 inch.*

#### NOTE

All ATG level measurements recorded in Step 1 must be adjusted for the new level offset value if the offset was changed.

The following formula can be used to determine the NEW Offset value:

$$\text{ATG Level} = (\text{ATG Step 1 Level} - \text{New Step 2 Offset}) + \text{Offset used in Step 1.}$$

To enter the NEW Offset value:

- a. From Main Menu Page, select Tanks.
- b. From Tanks Page, select Tank Setup Page.
- c. In Tank Setup Page, move cursor to Offset line.
- d. Enter Offset value using number and decimal point keys. Then, Press [enter] key to accept.

3. Adjust the LfactN Value to correct for the narrow probe level reading (6 inches below the 'W' tube on tall tanks or near full short tanks).

The following formula can be used to determine the correct LFactN value:

New LFactN =

$$\frac{\text{Manual Level} - \text{ATG Level}}{\text{Manual Level} - \text{RtoBot}} + \text{Old LFactN}$$

To enter the NEW LFactN value:

In Tanks Setup Page (Step 2), move cursor to LFactN line and enter correction amount, using the number and decimal keys. Then, Press [enter] to accept.

4. (**Tall Tanks Only**) Adjust LFactW value to correct the wide probe level reading (near full).

The following formula can be used to determine the correct LFactW:

New LFactW =

$$\frac{\text{Manual Level} - \text{ATG Level}}{\text{Manual Level} - \text{WtoBot}} + \text{Old LFactW}$$

To enter the NEW LFactW value:

In Tanks Setup Page (Step 2), move cursor to LFactW line and enter correction amount, using the number and decimal keys. Then, Press [enter] key to accept.

5. For tanks with **HtoR Density enabled**, adjust the LFactR value to correct the low level reading (6 inches below N).

The following formula can be used to determine the correct LFactR value:

New LFactR =

$$\frac{\text{Manual Level} - \text{ATG Level}}{\text{Manual Level} - \text{RtoBot}} + \text{Old LFactR}$$

To enter the NEW LFactR value:

In Tanks Setup Page (Step 2), move cursor to LFactR line and enter correction amount, using the number and decimal keys. Then, Press [enter] key to accept.

**(continued on next page)**

6. The **density adjustment factors** (DFactR, DFactN, DFactW) are adjusted as in the single point calibration procedure (para. 5-13.1) and set to the same values. If any minor differences in measured density are observed at the various tank levels, minor adjustments may be made to individual density adjustment factors.

## 5-15 LOGOUT

### Important!

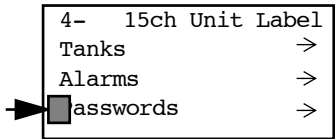
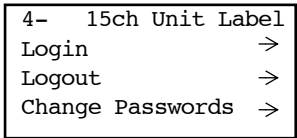
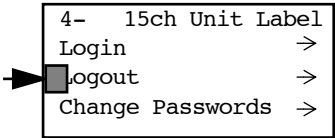
In order **to prevent unauthorized changes** to TCU settings, a user should **LOGOUT** when finished. To LOGOUT, locking the TCU, use the procedure in Table 5-25.

## 5-14 VERIFICATION

If verification of the system accuracy is required, perform procedures listed in API Manual of Petroleum Measurement Standards, Chapter 3 - Tank Gauging, Section 1B.

Calibration for this tank is complete. This procedure can be repeated for each tank in the system.

**Table 5-25 Logout Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORD line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2	Go to PASSWORD Page: <b>Press [enter] key.</b>		
3	Move cursor to LOGOUT line: (If cursor is on Logout line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	LOGOUT: <b>Press [enter] key.</b>		
5	<b>Press [esc] key</b> to return to the Main Menu Page		

## SECTION 6

### NORMAL OPERATION

#### 6-1 GENERAL

This section contains the following normal operation procedures:

**Table 6-1 Normal Op. Procedures Summary**

Operation	Table	Page
Login	6-2	6-1
Logout	6-3	6-4
TCU Unit# Selection	6-4	6-5
TCU Tank# Selection	6-5	6-6
Tank Measurement	6-6	6-8
Viewing Measurements	6-7	6-10
View/Acknowledge Alarms	6-8	6-11
Transfer	6-9	6-15
Theft/Leak Test	6-10	6-18

#### 6-2 LOGIN

When the system is locked, a user can view all display pages and start a leak/theft operation; however, no settings or variables can be changed and alarms cannot be acknowledged.

In order to make changes to a local TCU's settings, acknowledge alarms, or manually operate the local TCU's solenoid valves, the user must LOGIN on the local TCU, by entering a User Name and Password. Once logged in (local TCU unlocked), the user can view pages and make local setting changes (except user names and passwords). The Master Password is required to add, delete, or change user passwords, even if the system is unlocked.

If a user is logged in, the display cursor will alternate between the normal cursor and a "u" (indicating unlocked).

#### NOTE

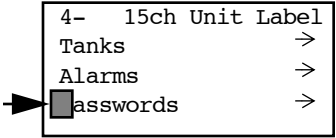

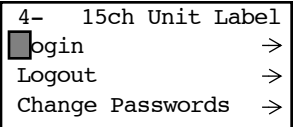
The Master Password cannot be used to LOGIN, a User Name and Password must be entered.

#### Network Access

If the TCU being used is locked, the user has view only access to any TCU on the network, along with the ability to start a leak/theft operation.

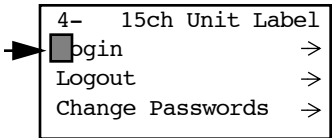
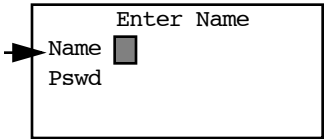
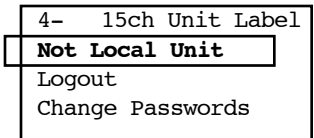
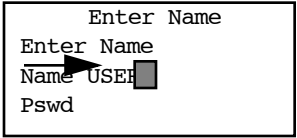

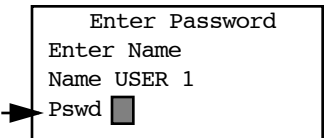
To LOGIN, use the procedure in Table 6-2.

**Table 6-2 Login Procedure**


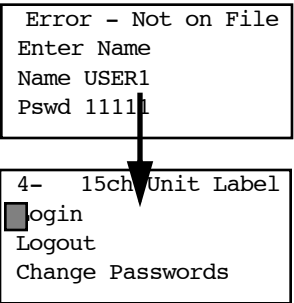
STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORD line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>		
2 	Go to PASSWORD Page: <b>Press [enter] key.</b>		



**Table 6-2 Login Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
3	Cursor starts at Login line. <b>If cursor is on Login line, go to Step 4...</b>  ...otherwise, Press UP Arrow key to move cursor to Login line.		
4	Go to LOGIN Page: <b>Press [enter] key.</b>		If login page is accessed, go to Step 5.
	<b>Error</b>	 <p>If "Not Local Unit" Error Message is displayed and login is desired, go to Unit Selection/Label Procedure (Table 5-6) on Page 5-13, change Unit No. to local unit, then repeat the login procedure.</p>	If Login line changes to "Not Local Unit," the local TCU is currently being used to view a remote TCU (Unit No. set to remote TCU's Unit No.) — <b>Login is not possible.</b>
5	Enter User NAME (1-character at a time): <b>For Number, (.), (-) and (/) keys, press appropriate key. Then, press [next] key to move cursor to next character.</b>  <b>Letter/Punctuation — press UP or DOWN Arrow key, until desired character is displayed. Then, Press [next] key to move cursor to next character.</b>	Selected character changes to number, symbol, or letter entered.  	
<b>Repeat Step 5, until all characters are entered.</b>			
6 	When all characters are entered, ACCEPT ENTRY: <b>Press [enter] key.</b>		Cursor automatically moves to the password line, ready for entry.

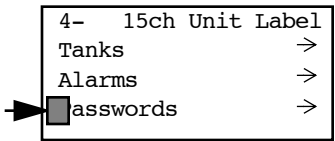
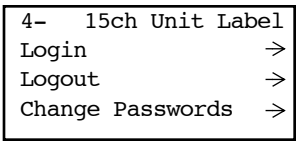
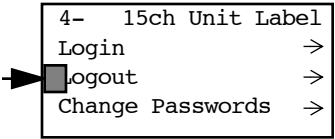
**Table 6-2 Login Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
7	Enter PASSWORD (1-character at a time):  (See Step 5 for specific procedures)	Selected character changes to number, symbol, or letter entered.  	Refer to Section 4 for information on entering data and information.
8	When all password characters are entered, ACCEPT ENTRY: Press [enter] key.	Error:  	Error message appears for a few seconds, then the display returns to the Password Page.  REPEAT Steps 3 - 10 w/correct user name and password.
9	To return to the MAIN MENU, Press [esc] key.		

### 6-3 LOGOUT

In order to prevent unauthorized changes to TCU settings, a user should LOGOUT when finished. To LOGOUT, locking the TCU, use the procedure in Table 6-3

**Table 6-3 Logout Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to PASSWORD line: (If cursor is on Password line, go to Step 2) <b>Press UP or DOWN Arrow key.</b>	 <pre> 4- 15ch Unit Label Tanks      -&gt; Alarms     -&gt; PASSWORDS  -&gt;           </pre>	
2	Go to PASSWORD Page: <b>Press [enter] key.</b>	 <pre> 4- 15ch Unit Label Login      -&gt; Logout     -&gt; Change Passwords -&gt;           </pre>	
3	Move cursor to LOGOUT line: (If cursor is on Logout line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>	 <pre> 4- 15ch Unit Label Login      -&gt; Logout     -&gt; Change Passwords -&gt;           </pre>	
4	LOGOUT: <b>Press [enter] key.</b>		
5	<b>Press [esc] key</b> to return to the Main Menu Page.		

## 6-4 UNIT SELECTION

The Series 3500 system operates on a local communications network. Each TCU (or computer) connected to the network can be used to monitor and control any other TCU on the network.

However, remote TCU control is limited to leak/theft operations. The local unit cannot be used to change a remote TCU's settings, strapping table information, or manually activate the remote TCU's solenoid valves.

### Unit Selection Location

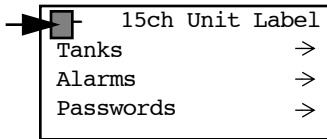
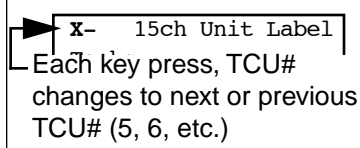
The TCU (Unit No.) can be selected only from the Main Menu Page and Tank Page. The Unit Label can be entered or changed only from the Main Menu Page.

### LOGIN Restrictions

The Unit Number of the local TCU cannot be changed, if the local unit is "unlocked" — a user is logged in.

To select a TCU Unit, use the procedure in Table 6-4.

**Table 6-4 Unit Selection Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU (or Tank Page) move cursor to the top line: <b>Press [tank] key.</b>		The [tank] key can be pressed from any line of a page where the unit number is accessible.  <b>If the TANK key is pressed twice (2X) in succession</b> , the local TCU being operated becomes the active unit and its current Unit number is displayed.
2	Select TCU Unit # to be used. If desired unit # is currently displayed, GO TO Step 4.  Display other network TCUs: <b>Press UP or DOWN Arrow keys</b>		If the local TCU is "unlocked," the following message screen will be displayed: <div style="border: 1px solid black; padding: 5px; text-align: center;">Logout Required</div> <b>LOGOUT</b> (see Table 6-3), then repeat the Unit Selection procedure.
3	Select TCU# currently displayed: <b>Press [enter] key.</b>	Accepts Unit # entry.	Cursor returns to position prior to Step 1 of this procedure.
4	<b>Press [esc] key</b> (returns cursor to position prior to this procedure).		

## 6-5 TANK SELECTION

Each TCU can control from one to four tanks. Tank information can be viewed from the associated TCU or any TCU/Display Unit connected to the network.

### Network Access

If the TCU being used is locked, the user has view only access to any TCU (and associated tanks ) on the network, along with the ability to start a leak/theft operation. An “unlocked” TCU (user logged in) cannot be used to access a remote TCU or it’s tanks.

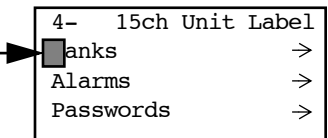
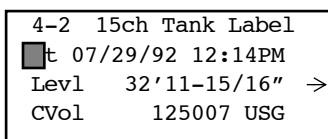
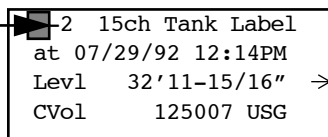
A TCU cannot be used to change settings, acknowledge alarms, or input strapping table information on remote TCUs. These operations must be done locally or via the Series 3500 PC Software.

### Tank Selection Location

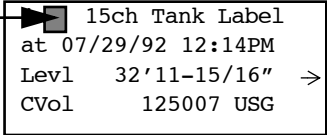
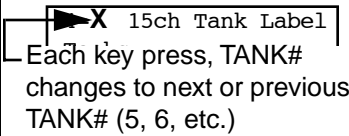
Any Tank connected to the currently selected TCU (Unit) can be accessed. The Tank Number can be selected only from the Tank Page.

To select a TANK on the network, use the procedure in Table 6-5.

**Table 6-5 Tank Selection Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU (or any page that has the Tank# and Tank Label line), move cursor to Tanks line: (If cursor is on Tanks line, go to Step 2) <b>Press UP or DOWN Arrow key</b>		
2	Go to TANK Page: <b>Press [enter] key</b>		
3	Move cursor to top line: <b>Press [tank] key</b>		If TANK key is pressed again, TCU # displayed becomes TCU # of unit.

**Table 6-5 Tank Selection Procedure (Cont.)**

<b>STEP</b>	<b>ACTION</b>	<b>RESULT</b>	<b>NOTES</b>
<b>4</b>	Move cursor to Tank #: <b>Press [next] key</b>		
<b>5</b>	Display other network TANKs: <b>Press UP or DOWN Arrow keys</b>		
<b>6</b>	Select TANK# currently displayed: <b>Press [enter] key.</b>	Accepts Tank# entry.	Cursor returns to position prior to Step 1 of this procedure.
<b>NOTE:</b> To go to the Previous Page, <b>Press [esc] key.</b>			

### 6-6 TANK MEASUREMENT

The Tank Page displays the date, time, and readings from the last measurement. The TCU measures each tank at the prescribed measurement interval. If the tank is in transfer, then the measurements of that tank are performed in succession until the measurement interval requires the TCU to measure other enabled tanks. Measurements of zero, density, and water are controlled by separate measurement intervals.

To take a full measurement, the local TCU must be unlocked at a Level 2 (Level 2 User logged in).

The required TCU Unit# and Tank# are selected, then the measurement process is started from the Tank Page.

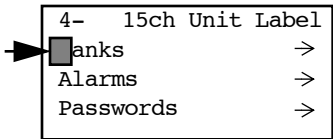
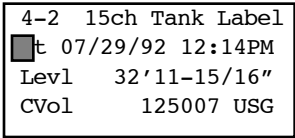
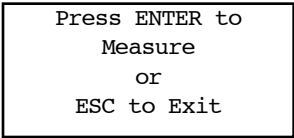
**NOTE**

During the measurement cycle, other TCU operations may be performed.

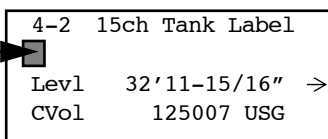
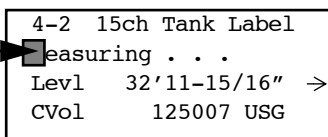
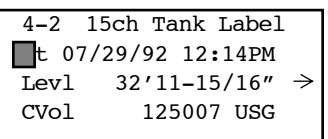
Full measurements require approximately five minutes to complete. When the TCU has completed the measurement, it updates the stored measurement information.

To perform a FULL TANK MEASUREMENT, use the procedure in Table 6-6.

**Table 6-6 Full Tank Measurement**

STEP	ACTION	RESULT	NOTES
1	Login at Level 2		See para. 6-2, Table 6-2 for Login procedure.
2	At the MAIN MENU, move cursor to line 2: (If cursor is on line 2, go to Step 2) <b>Press UP or DOWN Arrow key</b>		
3	Go to TANK Page: <b>Press [enter] key</b>		
4	Activate Tank Measurement:  With cursor on line 2, <b>Press [enter] key</b>		

**Table 6-6 Full Tank Measurement (Cont.)**

STEP	ACTION	RESULT	NOTES
5	Confirm Measurement Request:  <b>Press [enter] key</b> to start a measurement  <b>or</b>  <b>Press [esc] key</b> to exit		Once the measurement process starts, the display returns to the Tank Page screen.  <b>The second line will remain blank for about 30 seconds</b> while the system zeros the DPE.  Once the zero procedure is completed, the “Measuring...” message is displayed on the second line.
			While TCU is measuring a tank, other operations can be performed. All other pages are accessible.  <b>Once a measurement has started, the user cannot cancel the operation.</b>
			Pressing the [esc] key returns the screen to the Tank Page.
6	<b>To View Measurement Readings</b> — go to para. 6-7 (Table 6-6).		
<b>Note:</b> Press [esc] key to return to the Main Menu Page.			



## 6-7 VIEWING MEASUREMENT READINGS

Once the desired TCU (Unit#) and associated TANK (Tank#) have been selected (see Table 6-4, page 6-5 and Table 6-5, page 6-6), the current measurement readings can be viewed. The readings are displayed in the units selected in the Unit Setup Page.

### Ullage

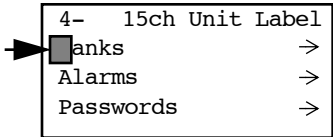
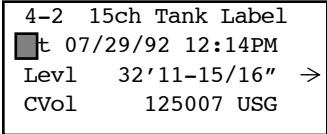
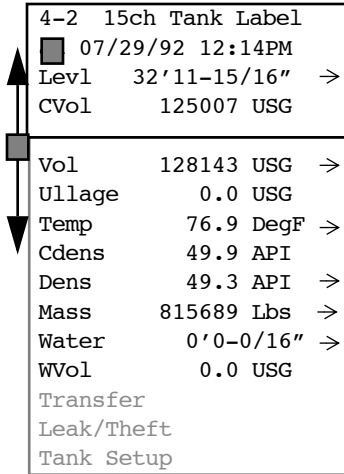
Ullage is the amount remaining to fill the tank.

### Network Access

Measurement readings for any tank on the network can be viewed from any TCU or Display Unit on the network.

To view the CURRENT MEASUREMENT READINGS, use the procedure in Table 6-7

**Table 6-7 View Measurement Procedure**

STEP	ACTION	RESULT	NOTES
1	At the MAIN MENU, move cursor to line 2: (If cursor is on line 2, go to Step 2) <b>Press UP or DOWN Arrow key</b>		
2	Go to TANK Page: <b>Press [enter] key</b>		
3	View Current Measurement Readings:  Scroll Display to view additional information, <b>Press UP or DOWN Arrow key</b> , as needed.		<b>Measurement Items Displayed:</b> <ul style="list-style-type: none"> <li>• Date and Time</li> <li>• Level</li> <li>• Corrected Volume</li> <li>• Volume</li> <li>• Ullage</li> <li>• Temperature</li> <li>• Corrected Density</li> <li>• Density</li> <li>• Mass</li> <li>• Water</li> <li>• WVol</li> </ul> Transfer, Leak/Theft, and Tank Setup are selections that go to other pages.

## 6-8 ALARMS

For detailed descriptions of alarms, refer to Section 7 - Troubleshooting and Maintenance.

### 6-8.1 Alarm Cursor

If an alarm condition exists, the cursor will change to a flashing **A<sub>L</sub>**. This alarm cursor appears **on all network TCUs, TDUs and connected computer** (no matter where on the network the alarm condition exists). The **A<sub>L</sub>** cursor remains active until all alarm condition(s) have been corrected.

### 6-8.2 TCU Alarm List

The ALARMS Page displays all alarms associated with the currently selected TCU Unit Number. To view another TCU's alarms, its Unit Number is selected. Only TCUs with alarm conditions will be displayed.

### 6-8.3 Alarm Details

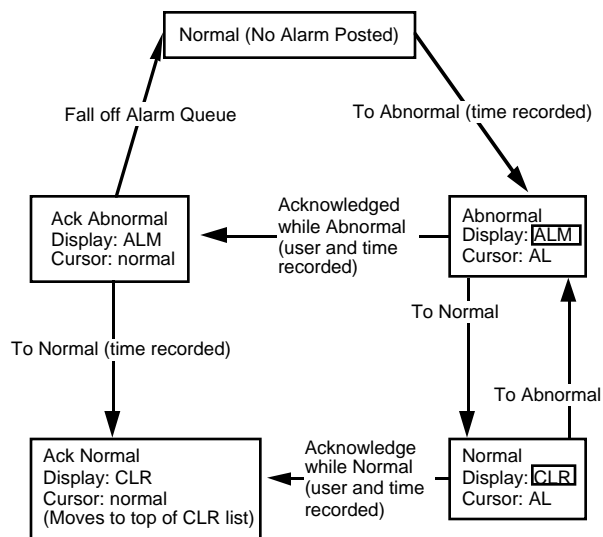
The ALARM DETAIL Page displays the selected alarm's date and time of occurrence, the current condition (abnormal or normal), and acknowledgment information.

- Abnormal - alarm condition still exists
- Normal - alarm condition no longer present

If an alarm condition self-corrects before acknowledgment, the display will indicate CLR. If the same alarm condition re-occurs before acknowledgment, the display will change back to ALM.

### 6-8.4 Acknowledge Alarms

Both Abnormal and Normal alarms should be acknowledged. The system must be unlocked (user logged-in) to acknowledge an alarm. When an alarm is acknowledged, the system records the date, time, and user name.



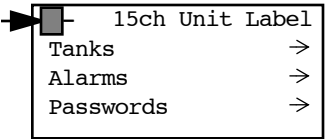
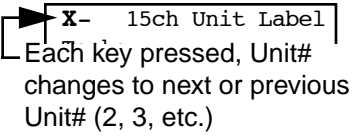
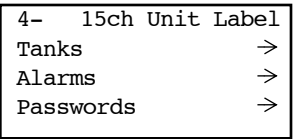
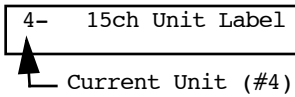
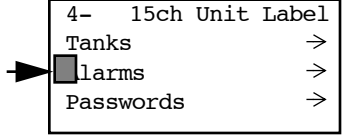
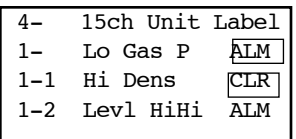

Notes: Abnormal is beyond alarm setpoint.  
Boxed ALM or CLR indicates flashing.

Figure 6-1 Alarm/Acknowledge Operation

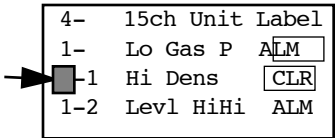
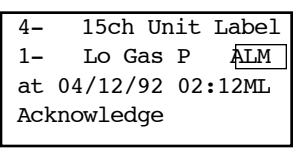
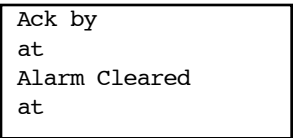
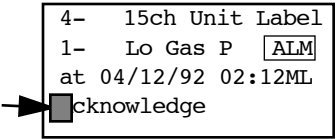
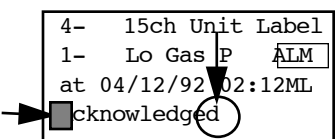
Table 6-8 View/Acknowledge Alarms Procedure

STEP	ACTION	RESULT	NOTES
1	<b>SELECT TCU UNIT NUMBER/VIEW ALARMS</b> (currently selected TCU Unit Number)		
	Alarms for currently selected TCU Unit Number are displayed on the Alarms Page. <b>To quickly select the local TCU</b> being operated: <ul style="list-style-type: none"> <li>• Press [tank] key twice</li> <li>• Press the [esc] key to return the cursor to its previous position.</li> </ul> <b>To view another TCUs Alarms/Alarm Details</b> , follow Steps 1a through 1c. <b>NOTE:</b> Alarms <b>cannot</b> be acknowledged from a remote TCU.		

**Table 6-8 View/Acknowledge Alarms Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>1</b>	<b>SELECT TCU UNIT NUMBER/VIEW ALARMS (continued)</b>		
<b>a)</b>	Move cursor to top line: <b>Press [tank] key.</b>		If the [tank] key is pressed again, the local TCU will be selected.
<b>b)</b>	Display other network Units (TCUs): <b>Press UP or DOWN Arrow keys</b>		Note: Only TCUs with alarm conditions will be displayed when scrolling through the unit numbers.
<b>c)</b>	When desired TCU Unit No. is displayed, Accept Unit No.: <b>Press [enter] key.</b>		When TCU Unit Number is changed, the new TCU (Unit) (and associated tanks) Alarms are displayed.  
<b>2</b>	At the Main Menu Page, Move the cursor to the Alarms line: <b>Press UP or DOWN Arrow Key</b>		
<b>3</b>	Go to the ALARMS PAGE: <b>Press [enter] key</b>		<b>Note:</b> Boxed ALM or CLR indicates flashing.
	<b>To view Alarm Details or acknowledge alarms for current TCU, go to Step 4.</b> <b>To exit Alarms Page, Press [esc] key to return to Main Menu Page.</b>		

**Table 6-8 View/Acknowledge Alarms Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>4</b>	<b>VIEW ALARM DETAILS</b> (and access Acknowledge Alarm Page)		
<b>a)</b>	Move cursor to desired alarm line: <b>Press UP or DOWN Arrow key.</b>	 <p>4- 15ch Unit Label 1- Lo Gas P ALM 1- Hi Dens CLR 1-2 Lev1 HiHi ALM</p>	
<b>b)</b>	Go to Alarm Detail Page: <b>Press [enter] key.</b>	 <p>4- 15ch Unit Label 1- Lo Gas P ALM at 04/12/92 02:12ML Acknowledged</p>	ALM = alarm condition still exists (uncorrected) CLR = alarm condition has been corrected  If alarm was acknowledged, the last line would read Acknowledged.
<b>c)</b>	To View 2nd Detail Page, <b>Press Down Arrow Key.</b>  To return to 1st Detail Page, Press Up Arrow Key.	 <p>Ack by at Alarm Cleared at</p>	If alarm was acknowledged, the user's name, date and time would be displayed.  If alarm was cleared, the date and time would be displayed.
	To return to the Alarms Page, press [esc] key.		
<b>5</b>	<b>ACKNOWLEDGE ALARMS</b> (currently displayed TCU Unit alarm) <b>Note:</b> User must be logged-in to acknowledge alarms. Alarms <b>cannot</b> be acknowledged from a remote TCU. Alarms must be acknowledged locally or via Series 3500 PC Software.		
<b>a)</b>	Go to the 1st Alarm Detail Page (If already on page, go to Step 5b) <b>Press UP Arrow key.</b>	 <p>4- 15ch Unit Label 1- Lo Gas P ALM at 04/12/92 02:12ML acknowledge</p>	
<b>b)</b>	Acknowledge Alarm: <b>Press [enter] key.</b>	 <p>4- 15ch Unit Label 1- Lo Gas P ALM at 04/12/92 02:12ML Acknowledged</p>	When an alarm is acknowledged, the user name and date/ time is recorded on the 2nd Detail page and the Acknowledge is changed to Acknowledged.
<b>c)</b>	To view the acknowledgment information, go to the <b>2nd Detail Page</b> by pressing the <b>Down Arrow key.</b>		
	<b>Repeat Steps (1) through (5),</b> as needed for each alarm or each TCU being checked. <b>Press [esc] key</b> to return to the Alarms Page or press [esc] key twice to return to Main Menu.		

## 6-9 TRANSFER

The TRANSFER function is an automatic operation. It is controlled by the transfer parameters entered on the Tank Setup Page.

The display indicates [Transfer in Progress] when the transfer mode is active. During the Transfer operation, the TCU measures hydrostatic pressure and updates the displayed transfer values.

When the transfer is complete, the TCU automatically takes level, density, and temperature readings, and enters the transfer information into the Transfer Log.

### Displayed Values

- Transfer Status
- Corrected Volume (CVol) Total
- Rate
- Estimated Full at (Est Full at)
- Ullage

The **TCVol** is a running total of the corrected volume transferred:

- (-) TCVol = Fluid Out
- (+) TCVol = Fluid In

The **Rate** is a running average of flow to or from tank.

The **Est Full at** value is the estimated time the tank will be full at the current rate of transfer.

The **Ullage** is a running value that indicates the amount of fluid required to fill the tank to the safe fill value.

These three values are updated at the pre-set Transfer Interval (Unit Setup Page).

### Transfer Log

As shown in Figure 6-2, the Transfer Log lists the TVol/CVol ending totals, Starting Level/Ending Level values, and the date and time (start/end) of each transfer — newest entries are listed first (on top).

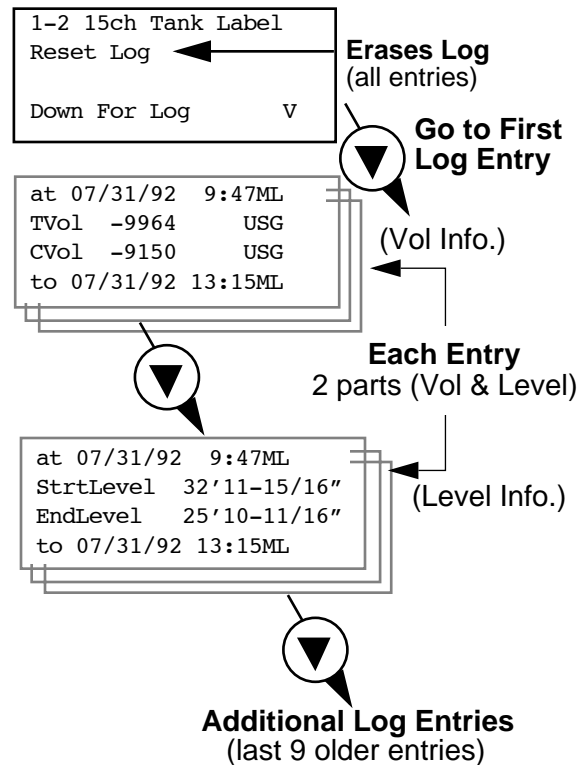


Figure 6-2 Transfer Log Example

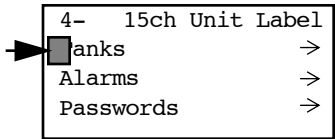
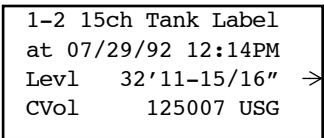
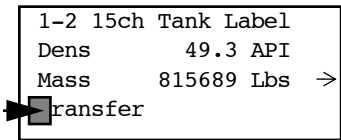
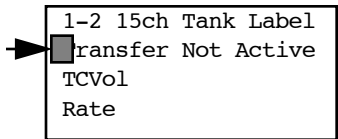

Transfer entries are maintained until log is reset or until 10 entries are accumulated. When 11th entry is made, the 10th entry (oldest) is erased.

### Network Access

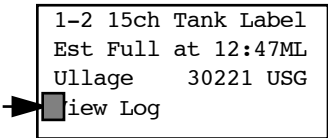
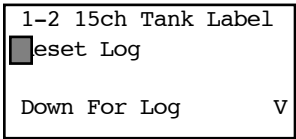
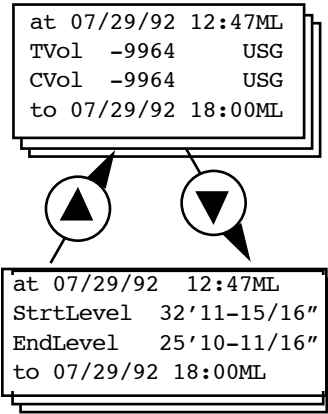
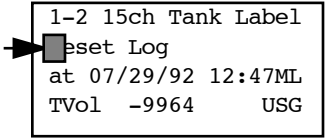
TCU (Unit#) and Tank# selection can be done before going to the Transfer Page, in the Transfer Page, or in the Transfer Log Page.

A transfer can be started/stopped from a remote TCU/TDU or computer.

**Table 6-9 Transfer Viewing Procedure**

STEP	ACTION	RESULT	NOTES
1	At the Main Menu Page, <b>select desired Unit# and Tank#</b> . See Table 6-3, page 6-5 for Unit# selection and Table 6-4, page 6-6 for Tank# selection.		
2	At the Main Menu Page, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 3) <b>Press UP or DOWN Arrow Key</b>	 <pre> 4- 15ch Unit Label └─ Tanks          &gt;   Alarms          &gt;   Passwords       &gt;           </pre>	
3	Go to TANKS PAGE: <b>Press [enter] key</b>	 <pre> 1-2 15ch Tank Label at 07/29/92 12:14PM Levl 32'11-15/16" &gt; CVol 125007 USG           </pre>	
4	Move cursor to TRANSFER line: (If cursor is on Transfer line, go to Step 5) <b>Press UP or DOWN Arrow key.</b>	 <pre> 1-2 15ch Tank Label Dens 49.3 API Mass 815689 Lbs &gt; └─ transfer           </pre>	
5	Go to TRANSFER Page: <b>Press [enter] key.</b>	 <pre> 1-2 15ch Tank Label └─ transfer Not Active   TCVol   Rate           </pre>	
	<b>To view Transfer Log</b> (Lists previous transfers with TVol, CVol, Date, and Time), <b>Go to Step 6.</b>		
	<b>VIEW TRANSFER VALUES</b> (ending TCVol, Rate, and Ullage values are displayed) <b>Press UP or DOWN Arrow Key</b> to scroll display to view values.		
	To Return to the Tank Page without viewing the Transfer Log, <b>Press [esc] key.</b> <b>To view Transfer Log</b> , go to Step 6.		

**Table 6-9 Transfer Viewing Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>6</b>	<b>VIEW/RESET TRANSFER LOG</b>		
a)	Move cursor to View Log line (last line) <b>Press DOWN Arrow key</b>	 <pre> 1-2 15ch Tank Label Est Full at 12:47ML Ullage      30221 USG View Log           </pre>	
b)	Go to Transfer Log Page: <b>Press [enter] key</b>	 <pre> 1-2 15ch Tank Label Reset Log  Down For Log      V           </pre>	
c)	<b>VIEW TRANSFER LOG</b> <b>Press Down Arrow key</b> , as needed, to view log pages in order from most recent to oldest.  <b>Press Up Arrow key</b> , as needed, to view previous log pages or to return to the Transfer Log Reset Page.	 <pre> at 07/29/92 12:47ML TVol  -9964      USG CVol  -9964      USG to 07/29/92 18:00ML           </pre> <pre> at 07/29/92 12:47ML StrtLevel 32'11-15/16" EndLevel  25'10-11/16" to 07/29/92 18:00ML           </pre>	<p>The log is displayed (1) page at a time.</p> <p>The arrow keys are used to move from page to page.</p>
	<b>RESET TRANSFER LOG</b>  With cursor on Reset Log line, <b>Press [enter] key.</b>	 <pre> 1-2 15ch Tank Label Reset Log at 07/29/92 12:47ML TVol  -9964      USG           </pre>	<b>Note:</b> The reset function deletes ALL log entries.
<b>7</b>	<b>Press [esc] key</b> to return to the Transfer Page (Step 6) or Press [esc] key twice (2X) to return to the Tank Page.		

## 6-10 TANK LEAK/THEFT

The TANK LEAK/THEFT function is used to start a test that measures the amount of fluid loss over a specific period of time. It is manually started from any TCU, TDU, or connected computer and continues until stopped.

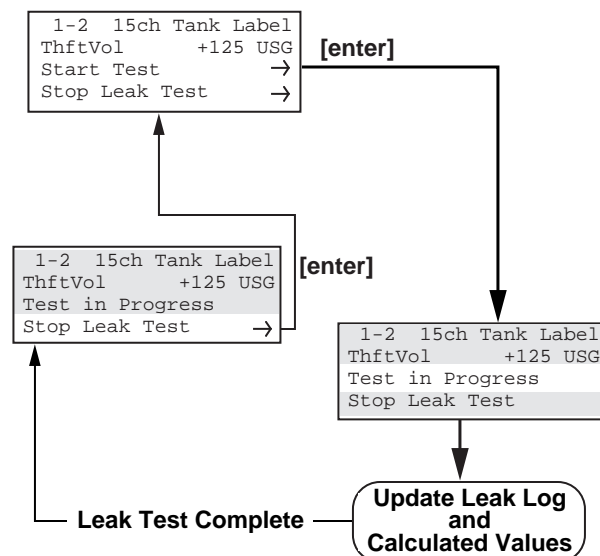


Figure 6-3 Leak/Theft Operation

As illustrated in Figure 6-3, the TCU starts a test when “Start Test” is selected. The unit will display the message “Test in Progress”. At the pre-set Leak Interval (Unit Setup Page), the TCU updates the Leak Log and displayed values.

When the leak test is complete, “Stop Leak Test” is selected. The display returns to the Leak Test Page. Theft volume alarm limit is checked against the final computation. If the final computations are over the set alarm limit, the system initiates the alarm. If the values are within limits, the final measurement values are displayed.

### Displayed Values

- Theft Volume (TVol) Total
- Rate
- TVol Alarm Setpoint
- Elapsed Time (Elap) since start of test

The **TVol** is a running total of the volume of fluid lost.

- (+) TVol = Fluid Out
- (-) TVol = Fluid In

The **Rate** is a running average of loss from the tank.

The **LVol Alarm** setpoint is a user set alarm. If TVol total exceeds this alarm setpoint, an alarm message is added to the Alarms Page for the TCU/Tank tested.

The **Elapsed Time** value is a running total of the amount of time since the start of the test.

The TVol, Rate, and Elapsed Time values are updated at the pre-set Leak Interval (Unit Setup Page).

### Leak Log

As shown in Figure 6-5, the Leak Log lists the Elapsed Time (Elap), Theft Volume (USG), and Rate (GPH) values for each interval measured.

1-2 15ch Tank Label		
Leak Test Started		
at 04/22/92 06:17ML		
Elap	USG	GPH
00:00	+0	+0
00:10	+0	+0
00:20	+12	+36

Figure 6-4 Leak Log Example

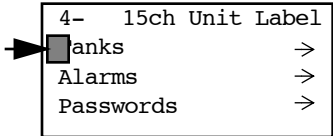
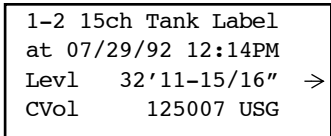
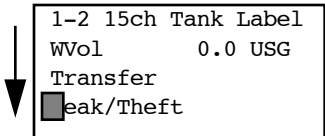
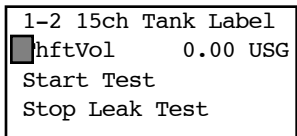
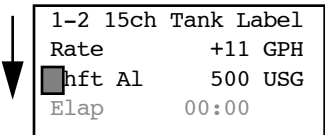
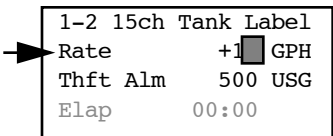

### Network Access

TCU Unit# and Tank# selection can be done before going to the Tank Leak/Theft Page, while in the Tank Leak/Theft Page, or while in the Tank Leak Log Page.

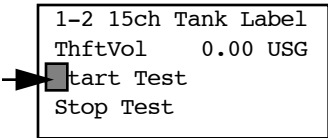
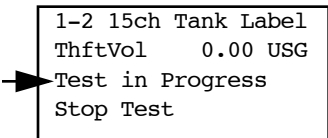
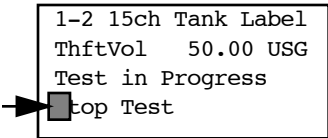

A Tank Leak Test can be started and stopped from a remote TCU or Display Unit.



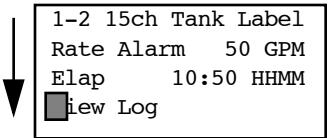
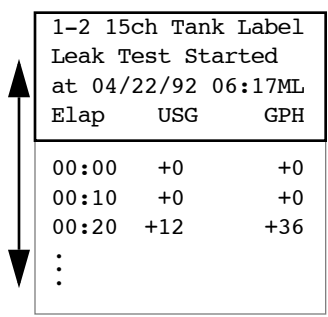
**Table 6-10 Tank Leak Test Procedure**

STEP	ACTION	RESULT	NOTES
1	<b>Login</b> (required to enter alarm values)		
2	<b>Select desired TCU (Unit#) and TANK (Tank#)</b> (see Table 6-1 [Unit] and Table 6-4 [Table]) <b>Note:</b> TCU Unit# and Tank# can be selected while in the Leak/Theft Page or Leak Log Page.		
3	At the MAIN MENU, move cursor to TANKS line: (If cursor is on Tanks line, go to Step 4) <b>Press UP or DOWN Arrow key.</b>		
4	Go to TANKS Page: <b>Press [enter].</b>		
5	Move cursor to LEAK/THEFT line: (If cursor is on Leak/Theft line, go to Step 6) <b>Press UP or DOWN Arrow Key.</b>		
6	Go to LEAK/THEFT PAGE: <b>Press [enter] key</b>		
7	<b>SET LEAK/THEFT ALARM VALUES</b> (Rate or ThftVol)		
a)	Move cursor to desired Alarm line (Rate) or (ThftVol). (If cursor is on desired line, go to Step 7b).  <b>Press UP or DOWN Arrow key</b> to scroll display.		
b)	Enter ALARM VALUE: • <b>Enter Value</b> • <b>Press [enter] key</b> to accept		Alarm values must be entered in units of measure displayed.
 c)	<b>Repeat Steps 7(a) and 7(b)</b> for remaining alarm setting.		

**Table 6-10 Tank Leak Test Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>8</b>	<b>START LEAK/THEFT</b>		
<b>a)</b>	Move cursor to Start Leak Test line: <b>Press UP or DOWN Arrow key.</b>		
<b>b)</b>	Select Leak Test: <b>Press [enter] key.</b>		
	<b>VIEW LEAK TEST CURRENT READINGS</b> (since last interval update) — Rate, ThftVol, Elap Time <b>Press UP or DOWN Arrow key</b> to scroll display until desired line is displayed.		
<b>9</b>	<b>STOP LEAK TEST</b> (Perform when leak test is complete.)		
<b>a)</b>	Move cursor to Stop Leak Test line: <b>Press UP or DOWN Arrow key.</b>		
 <b>b)</b>	Select Stop Leak Test — <b>Press [enter] key.</b>		

**Table 6-10 Tank Leak Test Procedure (Cont.)**

STEP	ACTION	RESULT	NOTES
<b>10</b>	<b>VIEW LEAK LOG</b>		
<b>a)</b>	Move cursor to View Log line (last line on page): <b>Press DOWN Arrow key.</b>		
<b>b)</b>	Go to Leak Log Page: <b>Press [enter] key.</b>  <b>Use Arrow keys</b> to move up and down through log.		
<b>11</b>	After viewing Leak Log, <b>Press [esc] key</b> to return to the Leak Page or <u>Press [esc] key twice (2X) to return to the Tank Setup Page.</u>		

## SECTION 7

### TROUBLESHOOTING AND MAINTENANCE

#### 7-1 GENERAL

This section contains information and procedures for troubleshooting, maintaining, and repairing the Series 3500.

#### 7-2 LIST OF TOOLS AND EQUIPMENT

The following tools and equipment will be needed to perform troubleshooting and maintenance on the Series 3500 TCU:

##### Tools

- Medium and Small Flat Tip Screwdrivers
- Phillips Screwdriver
- 7/16" and 9/16" Open-end Wrenches
- 12" Adjustable Wrench

##### Equipment/Supplies

- Digital Multimeter
- Leak Detect Solution

#### 7-3 ALARMS

##### 7-3.1 Overview

There is one Alarms Page that displays all TCU, system, and associated tank alarms for the currently selected TCU (Unit#). To view other

TCU's (and associated tanks) alarms, the desired TCU (Unit#) is selected while in the Alarms Page.

When abnormal conditions are detected by the TCU, a flashing alarm cursor (AL) is displayed on all TCUs, TDUs, and on any host computer connected to the network.

Alarms can result from measurements or calculations exceeding operator set control limits or from internal self-diagnostics checks. The specific alarm type, date and time of occurrence, and tanks involved can be displayed on any Network TCU, TDU, or host computer.

##### 7-3.2 Alarm Types

Table 7-1 is a summary of ATG System alarms. The TCU ALARMS are relevant to the entire TCU, TANK ALARMS are relevant to the measurement of a single tank, and are generated during the measurement of a tank. TANK-SP ALARMS indicate a user-entered setpoint value has been exceeded, but do not indicate a unit or measurement error.

**Table 7-1 ALARM SUMMARY**

Alarm Name	TCU/Tank	Description
Lo Gas P	TCU	Nitrogen supply tank pressure low
DPE 0 fail	TCU	DPE zero measurement failure
Bty Low	TCU	Memory backup battery low
Input V Low	TCU	TCU input voltage too low
SI Fuse BI	TCU	Solenoid supply fuse open
DPE Xsum	TCU	DPE coefficient memory checksum error
T Bypass	Tank	T Probe Bypass Failed
W Bypass	Tank	W Probe Bypass Failed
N Bypass	Tank	N Probe Bypass Failed
R Bypass	Tank	R Probe Bypass Failed
H Bypass	Tank	H Probe Bypass Failed
WtoT Bal H	Tank	WtoT Balance Failure during Hydro measurement
WtoT Ret H	Tank	WtoT Retry Failure during Hydro measurement

**Table 7-1 ALARM SUMMARY (Continued)**

RtoT Bal H	Tank	RtoT Balance Failure during Hydro measurement
RtoT Bal D	Tank	RtoT Balance Failure during Density measurement
RtoT Ret H	Tank	RtoT Retry Failure during Hydro measurement
RtoT Ret D	Tank	RtoT Retry Failure during Density measurement
HtoT Bal H	Tank	HtoT Balance Failure during Hydro measurement
HtoT Bal D	Tank	HtoT Balance Failure during Density measurement
HtoT Ret H	Tank	HtoT Retry Failure during Hydro measurement
HtoT Ret D	Tank	HtoT Retry Failure during Density measurement
RtoW Bal D	Tank	RtoW Balance Failure during Density measurement
RtoW Ret D	Tank	RtoW Retry Failure during Density measurement
RtoN Bal W	Tank	RtoN Balance Failure during Water measurement
RtoN Bal D	Tank	RtoN Balance Failure during Density measurement
RtoN Ret W	Tank	RtoN Retry Failure during Water measurement
RtoN Ret D	Tank	RtoN Retry Failure during Density measurement
HtoN Bal W	Tank	HtoN Balance Failure during Water measurement
HtoN Ret W	Tank	HtoN Retry Failure during Water measurement
Thft Volume	Tank-SP	Theft volume exceeded set point
CorrDen Err	Tank	Corrected density calculation exceeded API table 23 range
CorrV Error	Tank	Volume correction factor calculation exceeded API table 6 range
Temp HiHi	Tank-SP	Temperature input exceeded High-High set point
Temp Hi	Tank-SP	Temperature input exceeded High set point
Temp Lo	Tank-SP	Temperature input exceeded Low set point
Temp LoLo	Tank-SP	Temperature input exceeded Low-Low set point
Levl HiHi	Tank-SP	Level measurement exceeded High-High set point
Levl Hi	Tank-SP	Level measurement exceeded High set point
Levl Lo	Tank-SP	Level measurement exceeded Low set point
Levl LoLo	Tank-SP	Level measurement exceeded Low-Low set point
Volm HiHi	Tank-SP	Volume calculation exceeded High-High set point
Volm Hi	Tank-SP	Volume calculation exceeded High set point
Volm Lo	Tank-SP	Volume calculation exceeded Low set point
Volm LoLo	Tank-SP	Volume calculation exceeded Low-Low set point
Dens HiHi	Tank-SP	Density measurement exceeded High-High set point
Dens Hi	Tank-SP	Density measurement exceeded High-High set point
Dens Lo	Tank-SP	Density measurement exceeded High-High set point
Dens LoLo	Tank-SP	Density measurement exceeded High-High set point
Cvol HiHi	Tank-SP	Corrected volume calculation exceeded High-High set point

**Table 7-1 ALARM SUMMARY (Continued)**

Cvol Hi	Tank-SP	Corrected volume calculation exceeded High set point
Cvol Lo	Tank-SP	Corrected volume calculation exceeded Low set point
Cvol LoLo	Tank-SP	Corrected volume calculation exceeded Low-Low set point
Mass HiHi	Tank-SP	Mass calculation exceeded High-High set point
Mass Hi	Tank-SP	Mass calculation exceeded High set point
Mass Lo	Tank-SP	Mass calculation exceeded Low set point
Mass LoLo	Tank-SP	Mass calculation exceeded Low-Low set point
Water HiHi	Tank-SP	Water level measurement exceeded High-High set point
Water Hi	Tank-SP	Water level measurement exceeded High set point
T LiqLo Err	Tank	Low temperature probe failure
T LiqHi Err	Tank	High temperature probe failure
T Amb Error	Tank	Ambient temperature probe failure

**7-3.3 Configurable Alarms (Setpoints)**

Temperature, level, volume, density, and mass parameters have high, high-high, low, and low-low alarm limits; water has high-high and high alarm limits. These alarm limits are user configurable in the Unit Setup Page.

The user can also define and select default substitute values or select last measured value for temperature and density parameters when an alarm condition occurs.

**7-3.4 Diagnostic Alarms****7-3.4.1 Balance Tries Exceeded**

Failure to achieve two consecutive repeatable DPE readings after any purge routine.

**7-3.4.2 Bty Low**

RAM memory back-up battery power has dropped below 3.1 volts.

**7-3.4.3 Bypass Tries Exceeded**

A stable sensing tube purge was not achieved within the user set time limit.

**7-3.4.4 Corrected Density Error**

Data is not within the bounds or limits of correlation, per API Standard 2540.

**7-3.4.5 Corrected Volume Error**

Data is not within the bounds or limits of look up tables, per API Standard 2540.

**7-3.4.6 DPE Zero Failure**

Differential pressure transducer did not achieve a stable zero reading at start of measurement. Measurement routine ends and will not restart until next interval period.

**7-3.4.7 DPE Xsum**

Differential Pressure Transducer EPROM failed checksum routine.

**7-3.4.8 WtoT, RtoT, and HtoT BAL H (hydrostatic) Failure**

Failure to achieve repeatable DPE readings between two consecutive hydrostatic purge routines.

**7-3.4.9 Input V Low**

Power supply output has dropped below 8.8 volts.

**7-3.4.10 Theft Volume**

Leak/Theft volume limit exceeded.

**7-3.4.11 Lo Gas P**

Nitrogen supply cylinder is low; activated by the regulator pressure switch when the nitrogen supply cylinder pressure drops to 200 psi.

**7-3.4.12 S1 Fuse BI**

Solenoid fuse (TCU input board) is blown.

**7-3.4.13 T LiqLo Err**

Indicates either a bad lower temperature sensor or bad sensor connection (wiring).

#### 7-3.4.14 T LiqHi Err

Indicates either a bad lower temperature sensor or bad sensor connection (wiring).

#### 7-3.4.15 T Amb Error

Indicates either a bad Tank Top Junction Box ambient temperature sensor or bad sensor connection (wiring).

### 7-4.2 Troubleshooting Tables

Possible causes and remedies for typical problems are listed in Tables 7-2 through 7-3. These troubleshooting tables are organized as follows:

- Display Problems — Table 7-2
- Network Problems — Table 7-3
- Alarms — Table 7-4

## 7-4 TROUBLESHOOTING

### 7-4.1 General

In general, when troubleshooting the Series 3500 system, first determine the problem (e.g., an alarm condition), then determine the possible causes and corrective action.

**Table 7-2 TCU Display Troubleshooting**

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
"A <sub>L</sub> " Cursor Displayed	Alarm condition exists	Go to Alarms Page, view alarm, acknowledge alarm (if in alarm state ALM displayed), troubleshoot, and correct problem
Blank Display	No Supply Power	Check main power at circuit breaker
	Intensity Setting Incorrect	Adjust intensity trim pot (R11) on the TCU main board
	Faulty Display	Replace keyboard/display assembly
No Backlighting	Ribbon cable not connected	Power off TCU, reconnect cable, power on TCU
	Faulty Display	Replace keyboard/display assembly
Random Characters Displayed	Display cable disconnected and reconnected with TCU power on	Reset TCU or Superboot and download configuration
	Program Fault	Reset TCU or Superboot and download configuration

**Table 7-3 TCU Network Troubleshooting**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE(S)</b>	<b>CORRECTIVE ACTION(S)</b>
Remote viewing of TCU NOT accessible — "Node Not Active" message displayed	Specific TCU offline or removed from network.	Check Remote TCU condition
No remote TCUs accessible — "Node Not Active" message displayed	Network Short	Check Network Wiring and Connections, repair/replace wiring/connectors, as needed.
	Local TCU not communicating properly	Reset TCU or Superboot and download configuration
Local TCU not allowing viewing of all tank positions — "Node Not Active" message displayed	Local TCU not communicating properly	Reset TCU or Superboot and download configuration

**Table 7-4 TCU Alarms Troubleshooting**

<b>ALARM</b>	<b>POSSIBLE CAUSE(S)</b>	<b>CORRECTIVE ACTION(S)</b>
Balance Hydro Alarm W to T R to T H to T	Slight movement of product greater than balance tolerance.	Determine cause of movement and correct if possible.
	Leak in sensing line, solenoid valve, manifold fitting, or DPE tube fittings	Locate leak using leak-detect solution, repair or replace as needed.
Note: Balance Hydro alarms will occur only during full measurement request.		
Balance Density Alarm R to T H to T R to W R to N	Slight movement of product greater than balance tolerance.	Determine cause of movement and correct if possible.
	Leak in sensing line, solenoid valve, manifold fitting, or DPE tube fittings	Locate leak using leak-detect solution, repair or replace as needed.
Note: Balance Density alarms will occur only during interval measurement and full measurement request.		
Balance Water Alarm R to N H to N	Slight movement of product greater than balance tolerance.	Determine cause of movement and correct if possible.
	Leak in sensing line, solenoid valve, manifold fitting, or DPE tube fittings	Locate leak using leak-detect solution, repair or replace as needed.
Note: Balance Water alarms will occur only during interval measurement and full measurement request.		
Bty Low	Main Circuit Board DIP Switch #4 in OFF (down) position.	Place DIP Switch #4 in ON (up) position.
	Battery voltage level below 2.8V.	Replace RAM backup battery (see para. 7-9.7 for procedure).
By Tries Exc (Bypass Tries Exceeded) T Bypass W Bypass	Leak in sensing line, solenoid valve, manifold fitting, or DPE tube fittings	Locate leak using leak-detect solution, repair or replace as needed.



**Table 7-4 TCU Alarms Troubleshooting (Continued)**

<b>ALARM</b>	<b>POSSIBLE CAUSE(S)</b>	<b>CORRECTIVE ACTION(S)</b>
By Tries Exc (Bypass Tries Exceeded) T Bypass W Bypass N Bypass R Bypass H Bypass	Leak in sensing line, solenoid valve, manifold fitting, or DPE tube fittings	Locate leak using leak-detect solution, repair or replace as needed.
CorrDen Err	Possible Temp. Alarm condition. Corrected density calculation exceeded API table 23 range.	Correct temperature alarm condition.
CorrV Error	Possible Temp. Alarm condition. Corrected density calculation exceeded API table 6 range.	Correct temperature alarm condition.
Dens Hi, HiHi, Lo, or LoLo	Actual fluid density exceeds density limit setpoints.	Determine cause of fluid density exceeding limits — reset min./max. limits, if necessary.
	Incorrect density limit setpoints entered.	Enter correct density limit
	Fault condition present causing incorrect fluid density (density alarm condition).	Correct density alarm fault condition.
	Incorrect R to N or R to W separation value entered — greater than actual (causes Lo alarm).	Enter correct separation value.
	Incorrect R to N or R to W separation value entered — less than actual (causes Hi alarm).	Enter correct separation value.
	Incorrect substitute value entered.	Enter correct substitute value.
DPE 0 Fail	Faulty DPE connection.	Check DPE connector to main board.
	Faulty DPE Unit.	Replace DPE unit.
DPE Xsum	DPE EPROM Read Failure.	Check DPE connector to main board.
Input V Low	Fault in power supply output circuit.	Repair/replace, as needed.
	AC input voltage to power supply below 95 VAC.	Investigate cause, take required corrective action.
Theft Volume	Unauthorized movement of product in tank exceeding theft limit setpoint.	Investigate cause, take required corrective action.
	Theft limit setpoint too low or at zero.	Enter correct theft limit setpoint.

**Table 7-4 TCU Alarms Troubleshooting (Continued)**

<b>ALARM</b>	<b>POSSIBLE CAUSE(S)</b>	<b>CORRECTIVE ACTION(S)</b>
Levl Hi, HiHi, Lo, or LoLo	Incorrect R to N or R to W separation value entered — greater than actual (causes Lo alarm).	Enter correct separation value.
	Incorrect R to Bot or W to Bot separation value entered (causes Lo alarm).	Enter correct separation value.
	Open R-line (causes Lo alarm).	Reconnect, repair, or replace, as needed.
	Purge supply pressure low (cause Lo alarm).	Readjust regulator output to 20-25 psi.
	Restricted or blocked R or W line.	Clean, repair, or replace line.
Lo Gas P	Nitrogen supply cylinder pressure is below 200 psi.	Replace nitrogen supply cylinder.
	Nitrogen supply cylinder shutoff valve closed.	Open shutoff valve.
Mass Hi, HiHi, Lo, or LoLo	Incorrect level measurement (Level alarm may be present).	Determine cause of incorrect level measurement and correct condition.
	Incorrect density measurement (density alarm may be present).	Determine cause of incorrect density measurement and correct condition.
	Incorrect mass limits setpoint entered.	Enter correct mass setpoint.
S1 Fuse BI	Short in solenoid valve control cable.	Repair/replace cable and fuse.
	Short in solenoid valve.	Repair/replace solenoid valve and fuse.
Temp Hi, HiHi, Lo, or LoLo	Short between temp. probe leads (can cause Hi alarm).	Eliminate short or replace temp. probe assembly.
	Open, disconnected, or improperly connected temp. probe leads (can cause Lo alarm and display (-) negative temperatures).	Repair open circuit, reconnect leads, or replace temp. probe assembly.
	Faulty temperature probe (can read higher or lower than actual temp.).	Replace temperature probe.
	Fault on Tank Top Junction Box circuit board (component failure or moisture present).	Repair/replace Tank Top Junction Box circuit board.
	Incorrect temp. limits entered.	Enter correct temp. limit set-points.

**Table 7-4 TCU Alarms Troubleshooting (Continued)**

<b>ALARM</b>	<b>POSSIBLE CAUSE(S)</b>	<b>CORRECTIVE ACTION(S)</b>
Volm Hi, HiHi, Lo, or LoLo	Actual level has exceeded min./max. setpoints (corresponding level alarm may be present).	Correct improper level condition.
	Incorrect volume setpoints entered.	Enter correct setpoints.
	Fault in level measurement (corresponding level alarm may be present).	Correct condition causing level measurement fault.
Water Hi, HiHi	Water level measurement exceeds setpoints.	Remove water from tank.
	Restriction or blockage of W line.	Repair/replace W line.
T LiqLo Err T LiqHi Err T Amb Error (occurs when temp. exceeds -40°F or +160°F).	Temperature Sensor Failure.	Replace temperature sensor assembly.
	Tank Top Junction Box circuit board component failure or moisture present.	Repair/replace Tank Top Junction Box circuit board.

## 7-5 DIAGNOSTICS FUNCTIONS

### 7-5.1 Self-Diagnostics

The Series 3500 systems automatic internal self-diagnostic functions verify system operation and display an alarm message whenever any abnormal conditions are detected.

### 7-5.2 Manual Diagnostics

The manual diagnostics mode (Diagnostics Page) allows the user to toggle the TCU solenoid valves open and closed. The Diagnostics Page is a “hidden” Main Menu Page selection. It can only be accessed by entering a specific key sequence (see procedure Table 7-6 on page 7-12 and Table 7-6 on page 7-12).

#### NOTE

The valves can be toggled only after logging on to the system with a **Level 2** name/password.

As a part of the intrinsically-safe design, only (4) solenoid valves can be operated simultaneously.

### 7-5.3 Diagnostics Page Overview

The Diagnostics Page, as shown in Figure 7-1, displays the following information:

- Unit #., Tank#, and Tank Label
- DP readings
- Solenoid Valve Condition (open + or closed -)
- Ambient Air/Liquid Temperatures

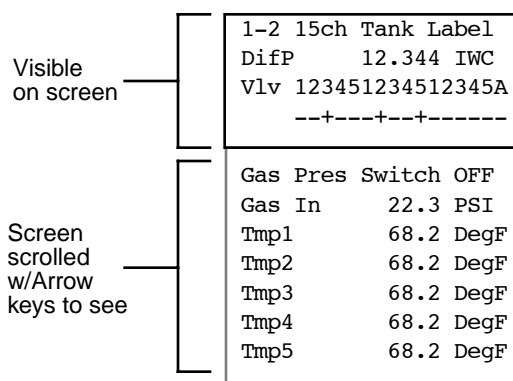


Figure 7-1 Diagnostics Page

As shown in Figure 7-2, Line 3 of the diagnostics page (labeled Vlv) indicates the solenoid valve positions. Reading line 3 from left to right, the first set of 5 numbers are for valves A1 through A5, the second set for valves B1 through B5, and the third set for valves C1 through C5.

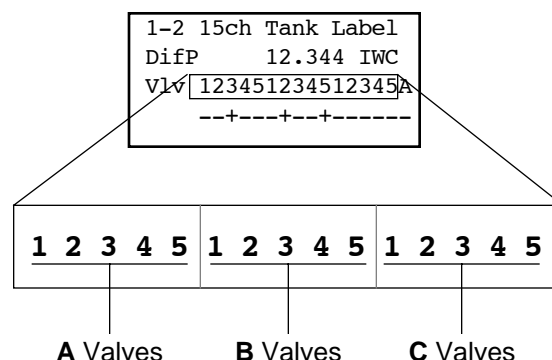


Figure 7-2 Vlv Display Sequence

As shown in Figure 7-2, the next line down indicates the condition of each valve. The dash line, or ‘-’ minus sign, indicates its corresponding valve is closed, and a ‘+’ plus sign indicates the valve is open.

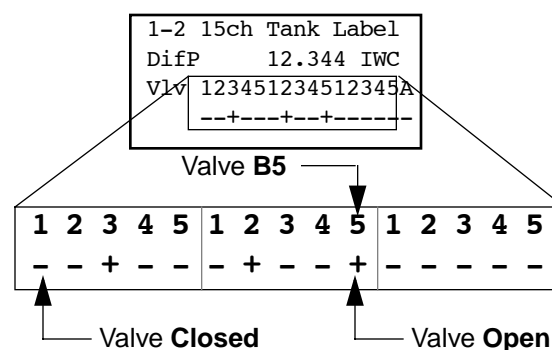


Figure 7-3 Vlv Condition Display

### 7-5.4 Viewing Automatic Valve Operation

Automatic valve operation during a level measurement sequence can be monitored by accessing the diagnostics page after an interval or on-demand measurement has been started.

While viewing the Diagnostics Page during the measurement sequence, the valve condition indicators will change from (-) to (+) or (+) to (-), indicating the opening or closing of the corresponding valve (as shown in Figure 7-2).

The sequence of valve operation depends on the TCU configuration (tank type setting, number of tanks, etc.).

Each tank configuration performs a standard routine for hydrostatic head between reference 'R' sensing tube and the tank top 'T' sensing tube, and a density measurement between reference 'R' to narrow range 'N' sensing tube. The sequence of valve operation differs on tall tank and water bottom measurement configurations.

### Tall Tank

The Tall tank configuration determines if the level is above the wide range 'W' sensing tube after the 'R' to 'T' measurement. If the level is above 'W', the program then performs a hydrostatic measurement from 'W' to 'T', followed by the density measurement between 'R' and 'W'.

### Water Measurement

The water measurement operation is performed following a complete level measurement operation. The differential pressure between the water sensing tube 'H' and narrow range 'N' is measured, and the resultant used in calculation of water bottom level.

### 7-5.5 Valve Designations

The following are the valve operations for the different measurement routines performed by the TCU. Refer to Table 7-5 for specific valve designations (parameters assigned to each valve that correspond to the probe sensor connected to that valve).

Tank specific parameters are shown with the assigned tank number in parenthesis (e.g., R(1)= R-probe in tank#1).

#### NOTE

On initial access of the diagnostic page an auto-zero check is performed. The H-purge valve A5 and L-purge valve C1 will open (+) for approximately 10 seconds then close (-).

When the DP line indicates the value in Inches-w.c., the auto-zero is complete — valves can be manually operated.

**Table 7-5 Valve Parameters**

VALVE	PARAMETER (Tank#)	Meas. Use			
		Hydro	Dens	Above W	Water
4- SHORT TANKS (WITHOUT WATER)					
A1	R(1)	X	X		
A2	R(2)	X	X		
A3	R(3)	X	X		
A4	R(4)	X	X		
A5	P <sub>H</sub> [Purge High]	X	X		
B1	B [Orifice Bypass]	X	X		
B2	N(4)		X		
B3	N(1)		X		
B4	N(2)		X		
B5	N(3)		X		
C1	P <sub>L</sub> [Purge Low]	X	X		
C2	T(4)	X			
C3	T(3)	X			
C4	T(2)	X			
C5	T(1)	X			
3-SHORT TANKS (WITH WATER)					
A1	R(1)	X	X		X
A2	R(2)	X	X		X
A3	R(3)	X	X		
A4	H(1)				X
A5	P <sub>H</sub> [Purge High]	X	X		X
B1	H(2)				X
B2	H(3)				X
B3	N(1)		X		X
B4	N(2)		X		X
B5	N(3)		X		X
C1	P <sub>L</sub> [Purge Low]	X	X		X

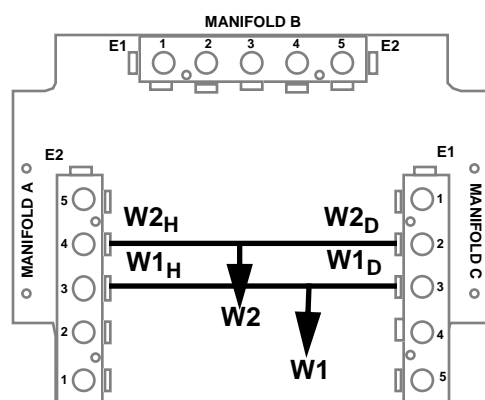
**Table 7-5 Valve Parameters (Continued)**

VALVE	PARAMETER (Tank#)	Meas. Use			
		Hydro	Dens	Above W	Water
C2	B [Orifice Bypass]	X	X		X
C3	T(3)	X			
C4	T(2)	X			
C5	T(1)	X			
<b>2-TALL TANKS (WITH or WITHOUT WATER)</b>					
A1	R(1)	X	X	D	
A2	R(2)	X	X	D	
A3	W(1) <sub>H</sub> [Hydro]			H	
A4	W(2) <sub>H</sub> [Hydro]			H	
A5	P <sub>H</sub> [Purge High]	X	X	X	X
B1	H(1)				X
B2	H(2)				X
B3	N(1)		X		X
B4	N(2)		X		X
B5	B [Orifice Bypass]	X	X	X	X
C1	P <sub>L</sub> [Purge Low]	X	X	X	X
C2	W(2) <sub>D</sub> [Density]			D	
C3	W(1) <sub>D</sub> [Density]			D	
C4	T(2)	X		H	
C5	T(1)	X		H	

**D = Density      H = Hydrostatic**

#### NOTE

As shown in Figure 7-4, W1 and W2 lines are common between manifolds A and C. These lines are used when the level is over 'W'.



(W1 & W2 lines used when level over 'W')

**Figure 7-4 'W' Line Connections**

## 7-6 MANUAL DIAGNOSTICS PROCEDURES

### 7-6.1 Overview

There are two basic measurement parameters that are checked with manual diagnostics:

1. Hydrostatic (Table 7-6)
2. Density (Table 7-6)

These checks are used in conjunction with the Alarms Troubleshooting Tables (Figure 7-3). If a hydrostatic error is suspected, the hydrostatic measurement check is performed. If a density error is suspected, the density measurement check is performed.

Refer to Table 7-5 for information on parameters assigned to specific valves.

### 7-6.2 Auto-Zero

Accessing the diagnostic page when a measurement routine is not in progress, the program first initiates an auto zero.

#### NOTE

Manual toggling of valves is not possible during a measurement or auto zero routine.

### 7-6.3 Hydrostatic Diagnostics Procedure

The Hydrostatic Diagnostics procedure checks the operation of the following valves and lines:

- T(x)
- R(x) or W(x) Hydro (Tall Tanks - level above 'W')
- P<sub>H</sub>
- P<sub>L</sub>

After the valves are opened and/or closed in sequence, the DP measurement reading is checked for stability. If the reading is not stable after approx. 30 seconds, the movement direction of the reading (increasing, decreasing, or

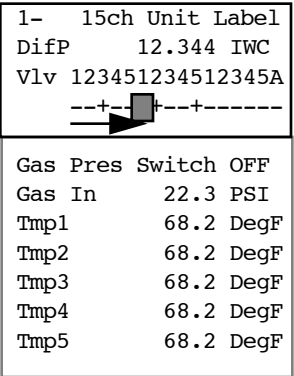
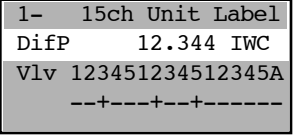
fluctuating) is used to determine possible problems in specific lines or solenoid valves.

To perform the hydrostatic diagnostics procedure, refer to Table 7-6.

**Table 7-6 Hydrostatic Diagnostics Procedure**

STEP	ACTION	RESULT	NOTES
1	<b>LOGIN</b> (If already logged-in, go to Step 2):  <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">Quick Reference</p> <ul style="list-style-type: none"> <li>• At Main Menu, move cursor (arrow key) to Passwords line, Press [enter] to select</li> <li>• Move cursor to Login line, Press [enter] key to select</li> <li>• Enter User Name &amp; Password</li> <li>• Press [enter] key, then [esc] key to return to Main Menu</li> </ul> </div> <p>(Refer to Section 6, Table 6-2 for detailed instructions)</p>		<p>A user must be logged-in to manually open or close solenoid valves.</p> <p><b>NOTE:</b> Manual diagnostic operations <b>cannot be performed from a remote TCU</b>. However, remote TCUs can be used to view automatic valve operation.</p>
2	<p>At the MAIN MENU, move cursor to Unit Setup line (last line): <b>Press DOWN Arrow key.</b></p>	<div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> 4- 15ch Unit Label Alarms Passwords Unit Setup </pre> </div>	
3	<p>Go to DIAGNOSTICS PAGE: <b>Press [-] key, then [help] key.</b></p> <p>(A blank line will be displayed at the bottom of the screen.)</p> <p><b>Press [enter] key</b> — the screen will change to the diagnostics page.</p>	<div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> 1- 15ch Unit Label DifP      12.344 IWC Vlv 123451234512345A --+----+---+-----  Gas Pres Switch OFF Gas In     22.3 PSI Tmp1      68.2 DegF Tmp2      68.2 DegF Tmp3      68.2 DegF Tmp4      68.2 DegF Tmp5      68.2 DegF </pre> </div>	<p>System will automatically perform an auto-zero.</p>

**Table 7-6 Hydrostatic Diagnostics Procedure (Continued)**

STEP	ACTION	RESULT	NOTES
4	<p><b>Manually Operate Valves:</b></p> <ul style="list-style-type: none"> <li>• Move cursor to desired valve number (Vlv), <b>Press [next] key</b></li> <li>• Open valve, <b>Press [-] key</b> If valve is to be open only momentarily, Press [-] key again to close</li> <li>• <b>Repeat</b> this step until all desired valves are open.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Valves to be opened (in sequence):</p> <ul style="list-style-type: none"> <li>• T(x)</li> <li>• R(x) or W(x) Hydro (Tall Tanks)</li> <li>• PH (momentarily open)</li> <li>• PL (momentarily open)</li> </ul> </div> <p>Note: (x) = Tank Number.</p>	 <p>The screenshot shows a menu with '1- 15ch Unit Label' at the top. Below it, 'DifP 12.344 IWC' and 'Vlv 123451234512345A' are displayed. A cursor is positioned over the 'Vlv' line. Below this, a status bar shows 'Gas Pres Switch OFF'. Further down, a list of temperatures is shown: 'Gas In 22.3 PSI', 'Tmp1 68.2 DegF', 'Tmp2 68.2 DegF', 'Tmp3 68.2 DegF', 'Tmp4 68.2 DegF', and 'Tmp5 68.2 DegF'.</p>	<p><b>Refer to Table 7-5 for valve number assigned to a specific parameter.</b></p> <p>Display will show a [+] symbol below an OPEN valve and a [-] symbol below a CLOSED valve.</p>
5	<p><b>Check DP value (DifP):</b> DP value should stabilize after approx. 30 seconds.</p>	 <p>The screenshot shows the same menu as in Step 4, but the cursor is now positioned over the 'DifP' line, which displays '12.344 IWC'.</p>	<p><b>Results:</b> If DP Value continues to change after 30 seconds, check the following valve(s) or line(s):</p> <ul style="list-style-type: none"> <li>• Going DOWN — leak in 'R' line or valve</li> <li>• Fluctuating (going UP, then DOWN) — leak in 'H'-purge line</li> <li>• Going UP — fuel entering tank</li> </ul>
6	<p>If <b>DP</b> value was <b>stable</b>, refer to Troubleshooting Chart (Table 7-3) for addition corrective actions.</p> <p>If <b>DP</b> value was <b>not stable</b>, check items suggested in Step 5 — Results, repair/ replace (as needed).</p> <p>To return to the Main Menu Page, <b>Press [esc] key.</b></p>		



## 7-6.4 Density Diagnostics Procedure

The Density Diagnostics procedure checks the operation of the following valves and lines:

- R(x)
- N(x) or W(x) Density (Tall Tanks - level above 'W')
- P<sub>H</sub>
- P<sub>L</sub>

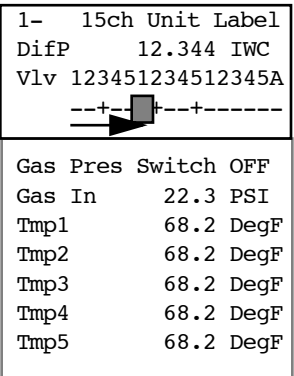
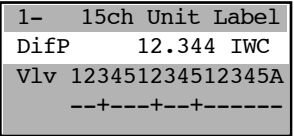
After the valves are opened and/or closed in sequence, the DP measurement reading is checked for stability. If the reading is not stable after approx. 30 seconds, the movement direction of the reading (up, down, or up and down) is used to determine possible problems in specific lines or solenoid valves.

To perform the density diagnostics procedure, refer to Table 7-6.

**Table 7-7 Density Diagnostics Procedure**

STEP	ACTION	RESULT	NOTES
1	<b>LOGIN</b> (If already logged-in, go to Step 2):  <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">Quick Reference</p> <ul style="list-style-type: none"> <li>• At Main Menu, move cursor (arrow key) to Passwords line, Press [enter] to select</li> <li>• Move cursor to Login line, Press [enter] key to select</li> <li>• Enter User Name &amp; Password</li> <li>• Press [enter] key, then [esc] key to return to Main Menu</li> </ul> </div> (Refer to Section 6, Table 6-2 for detailed instructions)		A user must be logged-in to manually open or close solenoid valves.
2	At the MAIN MENU, move cursor to DIAGNOSTICS line: <b>Press UP or DOWN Arrow key.</b>	<div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> 4- 15ch Unit Label   Passwords   Unit Setup   diagnostics           </pre> </div>	
3	Go to DIAGNOSTICS PAGE: <b>Press [enter] key.</b>	<div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> 1- 15ch Unit Label DifP      12.344 IWC Vlv 123451234512345A   --+---+---+-----  Gas Pres Switch OFF Gas In      22.3 PSI Tmp1        68.2 DegF Tmp2        68.2 DegF Tmp3        68.2 DegF Tmp4        68.2 DegF Tmp5        68.2 DegF           </pre> </div>	System will automatically perform an auto-zero.

**Table 7-7 Density Diagnostics Procedure (Continued)**

STEP	ACTION	RESULT	NOTES
4	<p><b>Manually Operate Valves:</b></p> <ul style="list-style-type: none"> <li>• Move cursor to desired valve number (Vlv), <b>Press [next] key</b></li> <li>• Open valve, <b>Press [-] key</b> If valve is to be open only momentarily, Press [-] key again to close</li> <li>• <b>Repeat</b> this step until all desired valves are open.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Valves to be opened (in sequence):</p> <ul style="list-style-type: none"> <li>• T(x)</li> <li>• N(x) or W(x) Hydro (Tall Tanks)</li> <li>• PH (momentarily open)</li> <li>• PL (momentarily open)</li> </ul> </div> <p>Note: (x) = Tank Number.</p>	 <p>The screenshot shows a menu with the following text:  1- 15ch Unit Label  DifP 12.344 IWC  Vlv 123451234512345A  --+-+-----  Gas Pres Switch OFF  Gas In 22.3 PSI  Tmp1 68.2 DegF  Tmp2 68.2 DegF  Tmp3 68.2 DegF  Tmp4 68.2 DegF  Tmp5 68.2 DegF</p>	<p><b>Refer to Table 7-5 for valve number assigned to a specific parameter.</b></p> <p>Display will show a [+] symbol below an OPEN valve and a [-] symbol below a CLOSED valve.</p>
5	<p><b>Check DP value (DifP):</b> DP value should stabilize after approx. 30 seconds.</p>	 <p>The screenshot shows a menu with the following text:  1- 15ch Unit Label  DifP 12.344 IWC  Vlv 123451234512345A  --+-+-----</p>	<p><b>Results:</b> If DP Value continues to change after 30 seconds, check the following valve(s) or line(s):</p> <ul style="list-style-type: none"> <li>• Going DOWN — leak in 'N' line or valve</li> <li>• Fluctuating (going UP, then DOWN) — leak in 'H'-purge line</li> <li>• Going UP — fuel entering tank</li> </ul>
6	<p>If <b>DP</b> value was <b>stable</b>, refer to Troubleshooting Chart (Table 7-3) for addition corrective actions.</p> <p>If <b>DP</b> value was <b>not stable</b>, check items suggested in Step 5 — Results, repair/ replace (as needed).</p> <p>To return to the Main Menu Page, <b>Press [esc] key.</b></p>		

## 7-7 TCU RESET PROCEDURES

### 7-7.1 Main Circuit Board

The Main Circuit Board contains the TCUs processor, memory, dip switches, and input/output circuitry. The DIP switches control several functions: reset, “superboot”, and memory backup battery operation.

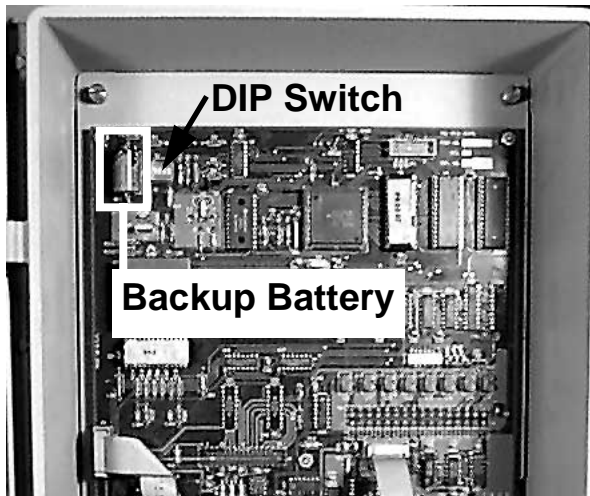


Figure 7-5 Main Circuit Board

The DIP switch, shown in Figure 7-5, has the following basic settings:

- Switch 1 - resets TCU processor when toggled from ON to OFF. Reset does not affect configuration information. The normal position for Switch 1 is OFF.
- Switch 2 - is used in conjunction with Switch 1 to perform a “superboot.” The normal position for Switch 2 is OFF.

#### NOTICE

A “superboot” will erase ALL configuration, setup, and stored variable information.

- Switch 3 - not used. The normal position of Switch 3 is OFF.
- Switch 4 - connects the on-board memory backup battery. The normal position for Switch 4 is ON. During storage or long periods of nonuse, Switch 4 should be OFF.

### 7-7.2 Memory Backup Battery Activation Procedure

The Memory Backup Battery on the Main Circuit Board (see Figure 7-5) maintains TCU settings and memory for approximately 6 months when main power is lost. If this battery is not on and main TCU power is lost, all settings and stored data will be erased.

#### NOTICE

The Memory Backup Battery should be turned on before initial setup/configuration.

If this battery is not on and main TCU power is lost, all settings and stored data will be erased.

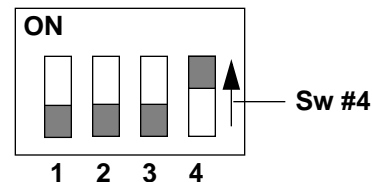


Figure 7-6 MEM Battery- DIP Switch Setting

To turn on the Memory Backup Battery, set DIP Switch #4 to ON (UP), per Figure 7-6.

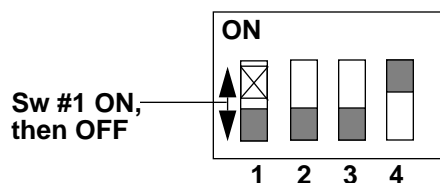
#### Extended Storage:

If the TCU is removed from service for an extended period of time (over 3 months), DIP Switch #4 should be turned off to conserve backup battery power.

#### NOTICE

When a TCU that has been removed from service is placed back into service, DIP Switch #4 must be turned on and setup and configuration procedures in Section 5 must be performed.

### 7-7.3 Reset Procedure

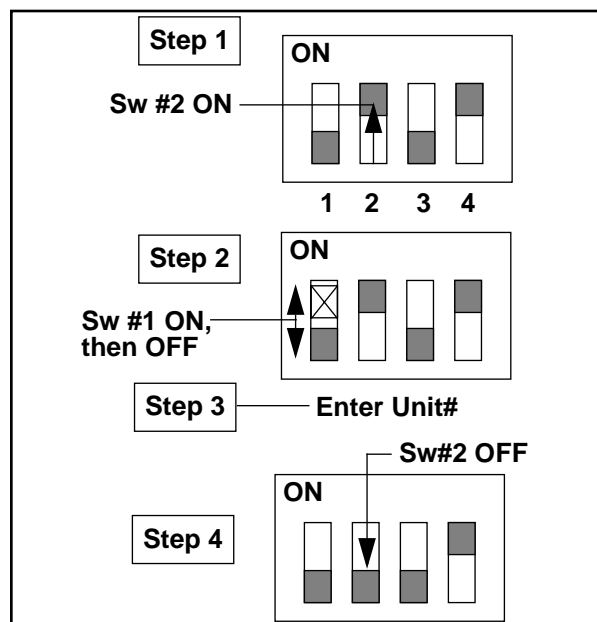


**Figure 7-7 RESET - DIP Switch Setting**

To reset the TCU, set DIP SW #1 to ON, then return it to the OFF position, per Figure 7-7. This causes the TCU to restart. This interrupts system calculations, but does not affect configuration or log data.

### 7-7.4 “Superboot” Procedure

The “superboot” procedure erases all configuration information and log data. A “superboot” is required whenever the EEPROM chip has been replaced.



**Figure 7-8 “Superboot”- DIP Switch Settings**

To “superboot” the TCU:

1. Switch #1 - OFF; Switch #2 - ON
2. Set Switch #1 - ON, then return it to the OFF position.
3. Enter TCU Unit Number (see LCD display).
4. Set Switch #2 - OFF.

## 7-8 PERIODIC MAINTENANCE/INSPECTION

### 7-8.1 General

The only routine maintenance required is replacement of the Series 3500's nitrogen supply cylinder.

### 7-8.2 Inspection

The following should be checked or inspected:

- Ground cables/wires are properly attached
- Nitrogen Supply Pressure
- Output Gauge Indication
- Tube fittings (tight)/Tubing (not pinched)
- Wire connections (tight)/Cables (not pinched)

### 7-8.3 Nitrogen Supply Replacement

The low gas pressure alarm will be activated when the nitrogen supply pressure drops to 200 psi. The cylinder should be replaced within 30 days. Follow all safety procedures when handling high pressure compressed gas cylinders.

## 7-9 COMPONENT REPLACEMENT

### 7-9.1 Replacement Items

The following are possible replacement items:

#### TCU:

- Solenoid Valve
- Main Circuit Board Assembly
- Input Board Assembly
- Display/Keypad Assembly
- Power Supply
- Differential Pressure Transducer
- Low Gas Pressure Switch

#### Display Unit:

- Main Circuit Board Assembly
- Input Board Assembly
- Display/Keypad Assembly
- Power Supply Circuit Board Assembly
- RS-232 Converter
- Network Barrier Assembly

#### Probe Assembly:

- Temperature Probe Assembly

#### Tank Top Box:

- Temperature Probe Assembly
- Tank Top Junction Box Circuit Board

## 7-9.2 Opening TCU Enclosure



Figure 7-9 Opening TCU Enclosure

1. Disconnect main power to the explosionproof power supply.
2. Open the TCU enclosure, by unscrewing (2) knurled screws located on the front door outside edge.

## 7-9.3 Keypad/Display Assembly Replacement

The Keypad/Display assembly can be replaced in the field, using the following procedure:

1. Disconnect main power to the explosionproof power supply.
2. Open the TCU enclosure, by unscrewing (2) fast-disconnect screw latches located on the front door outside edge.

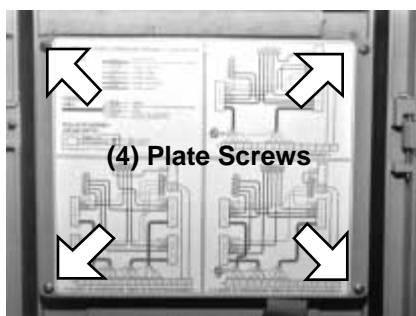


Figure 7-10 Display/Keypad Cover Plate

3. Remove the protective plate (wiring diagram label) by unscrewing (4) phillips screws.

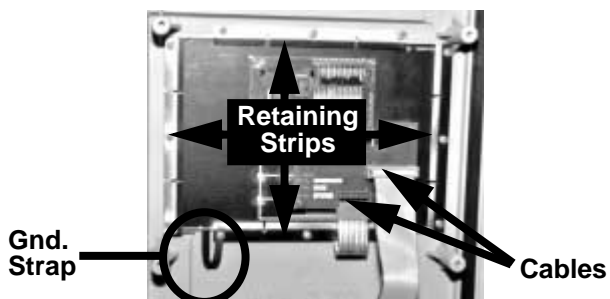


Figure 7-11 Display/Keypad Assembly (cover removed)

4. Disconnect the display/keypad ribbon cable from the display/keypad circuit board.
5. Remove display/keypad retaining strips, by unscrewing (3) phillips screws on each strip. Be careful not to damage the grounding ribbon cables connected to the bottom strip's left screw.
6. Carefully pull the display/keypad assembly away from the enclosure door.
8. To install new keypad display, reverse this procedure.

## 7-9.4 Input Board Assembly

The Input Board assembly can be replaced in the field, using the following procedure:

1. Turn OFF main power to the explosionproof power supply.
2. Open the TCU enclosure, by unscrewing (2) captive screws located on the front door.



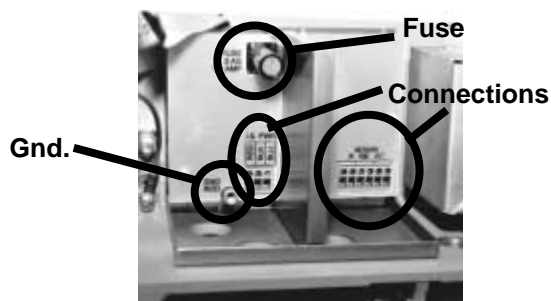
Figure 7-12 Input Board Assy. Location

3. Disconnect the input board ribbon cable from the main circuit board.



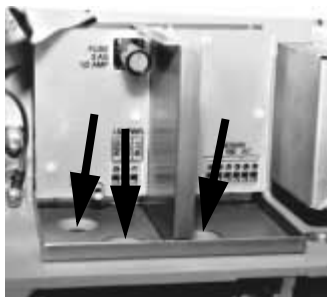
**Figure 7-13 Input Box Cover/Latch**

4. Pull up on the input box cover latch and remove the cover by lifting up and out. The I.S. power terminals, solenoid valve fuse, ground rod connection and network communication terminals are now accessible.



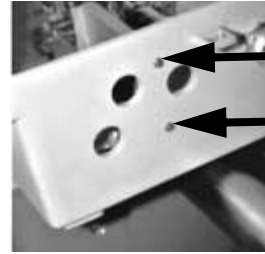
**Figure 7-14 Input Board Connections**

5. Disconnect the I.S. power leads, ground rod cable, and network communication leads.



**Figure 7-15 Input Box Conduit Ports**

6. Remove the (3) conduit lock nuts.



**Figure 7-16 Input Box Mounting Screws**

7. Remove the input board assembly, by unscrewing (2) slot head screws at the box base and support.
8. Replace the input board assembly in the reverse sequence.

#### **7-9.5 DPE**



**Figure 7-17 DPE Location**

#### **NOTICE**

Before disconnecting the main power, have all TCU configuration data records on file or saved on disk.

1. Disconnect main power to the explosionproof power supply.
2. Open the TCU enclosure, by unscrewing (2) captive screws located on the front door.



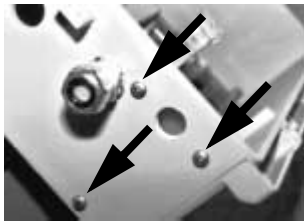
**Figure 7-18 DPE to Main Board Cable**

4. Disconnect the DPE ribbon cable from the main TCU board.



**Figure 7-19 DPE Pressure Sensing Lines**

5. Remove the pressure sensing lines from the DPE. Use 7/16 inch open end wrench. If necessary, mark lines for reconnecting identification.

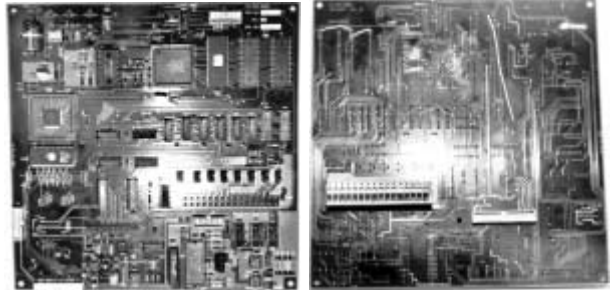


**Figure 7-20 DPE Mounting Screws**

6. Remove the DPE by, unscrewing (3) mounting screws, accessible from bottom of TCU enclosure.
7. Install the replacement DPE in the reverse order.
8. Turn on the main power to the TCU explosionproof power supply.
9. Perform a full level measurement, and check for leaks at the DPE connections. Correct leaks as required.
10. Once system is leak tight and functioning properly, close the TCU enclosure and tighten the captive screws.

## **7-9.6 Main Circuit Board**

### **7-9.6.1 Board Removal**

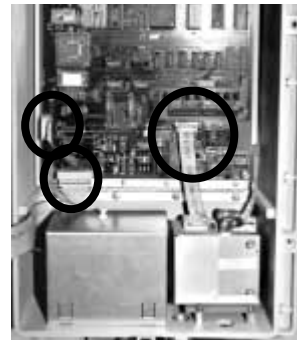


**Figure 7-21 TCU Main Board (Front/Back)**

#### **NOTICE**

Before disconnecting the main power, save all TCU configuration files and data records to disk.

1. Disconnect the main power to the explosion-proof power supply.
2. Open the TCU enclosure, by unscrewing the (2) knurled screws on the right edge of the enclosure front door.



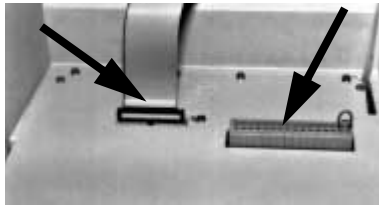
**Figure 7-22 Main Board (Front) Cables**

3. Disconnect the keypad-display, input board, and DPE ribbon cables.



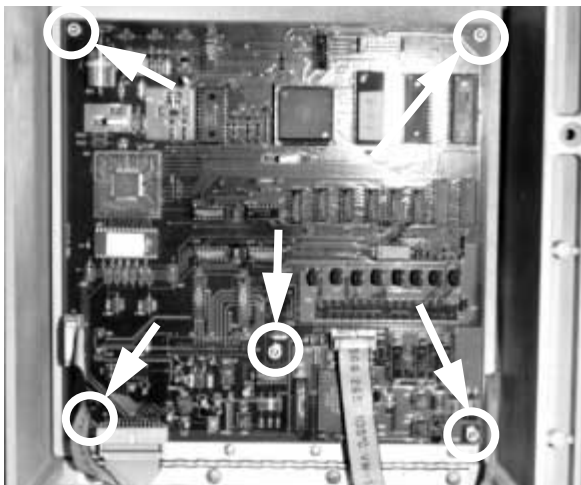
**Figure 7-23 TCU Board Door Panel Screws**

4. Open the main board support/manifold access, by unscrewing the (2) knurled screws at the upper corners.



**Figure 7-24 TCU Board (Back) Cables**

5. Disconnect the solenoid valve, the temperature probe, and the pressure switch cables.



**Figure 7-25 Main Board Support Screws**

6. Remove the main board from its support, by unscrewing (5) 1/4-inch nuts and removing associated washers.

#### **NOTICE**

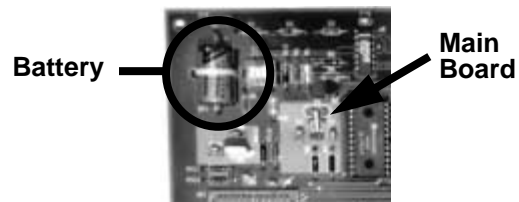
If replacing board, turn off the battery backup switch (S1-4) on the board being removed.

#### **7-9.6.2 Board Installation**

1. Turn OFF main power to the explosionproof power supply.
2. Turn ON the battery backup switch (S1-4) on the board being installed.
3. Install the new main board, using the (5) nuts and washers removed in Step 6 of Removal Procedure (see 7-9.7.1)
4. Connect keypad/display, input board, and DPE cables.
5. Open main board/manifold access panel, and reconnect the solenoid valve, temperature probe, and pressure switch cables (refer to wiring diagram for correct connections).

6. Close and secure the main board/manifold access panel, using the two knurled screws at the top of the panel.
7. Perform a “superboot,” if a new **unconfigured** main board has been installed, per the following procedure:
  - a) Set switch S1-1 to OFF and S1-2 to ON.
  - b) Turn on the main power to the TCU explosionproof power supply.
  - c) Enter TCU Unit# (see LCD display).
  - d) Set switch S1-2 to OFF.
8. Reconfigure the TCU, using procedures found in Section 5.

#### **7-9.7 Backup Battery Replacement**



**Figure 7-26 Backup Battery Location**

#### **NOTICE**

Before turning OFF main power, have all TCU configuration data/records saved on disk.

1. Perform the main circuit board removal procedures listed in 7-9.6.1.



**Figure 7-27 Backup Battery Leads**

- 2) Move the main board to a safe area. Remove the backup battery from the board, by unsoldering the battery leads from the main board.
- 3) Install the new battery, observing polarity (+) side up, and solder in place.
- 4) Install the main board, per procedures listed in para. 7-9.6.2.



### 7-9.8 EPROM (program chip)

#### NOTICE

Before turning OFF main power, save all TCU configuration and data records to disk.

1. Turn OFF main power to the TCU explosion-proof power supply.
2. Open the TCU enclosure, by unscrewing (2) captive screws on located on the front door.

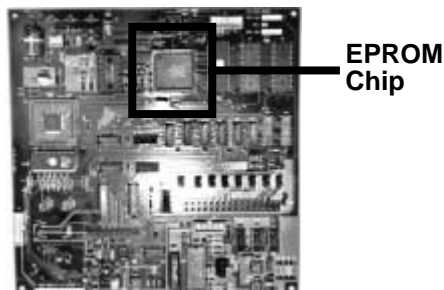


Figure 7-28 EPROM Chip Location

3. Carefully remove the EPROM program chip, using an I.C. removal tool or by slowly pulling up one end of the chip, then the other, until the chip is removed from its' socket.
4. Install the new EPROM program chip, by properly aligning the pins to the socket holes (w/notched end up) and pressing down on the chip until it is fully seated in the socket.
5. If replacement was due to a faulty chip, turn on the main power — the system is now operational.

#### NOTICE

If replacement was due to a program upgrade, then a system "superboot" may be required, followed by TCU reconfiguration.

### 7-9.9 Solenoid Manifold

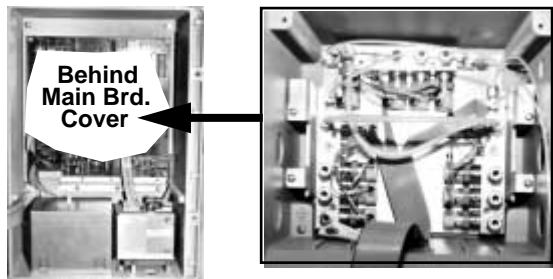


Figure 7-29 Solenoid Valve Manifold Location

1. Turn OFF main power to the explosionproof power supply.
2. Shut off the nitrogen cylinder supply valve.
3. Open the TCU enclosure, by unscrewing (2) knurled screws located on the front door.
4. Lower the main board support assembly to gain access to the manifold assembly, by unscrewing (2) captive slotted/knurled screws located at the top corners.

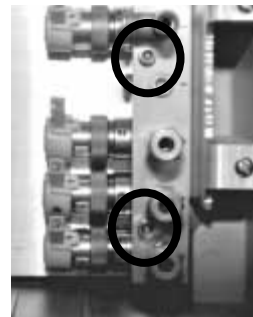
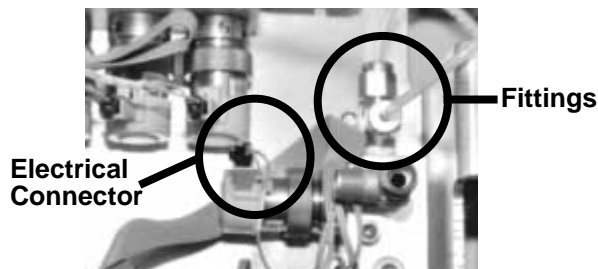


Figure 7-30 Manifold Mounting Screws

5. Remove (2) manifold mounting screws and pull manifold away from case wall.
6. Remove valves, fittings, and connectors from old manifold and install on new manifold, using thread tape on NPT side of tube fittings (see 7-9.10 for solenoid valve replacement procedures).
7. Install new manifold assembly.
8. Reconnect pneumatic tubes to their corresponding fittings and electrical connector plugs to their corresponding solenoid valves.
9. Re-connect main power to the explosionproof power supply.
10. Perform level measurements for each tank connected to the TCU.
11. Check for leaks on manifold, correct as required.
12. When satisfactory results are achieved, close the main board/manifold access door and secure. Close the TCU enclosure door and secure.

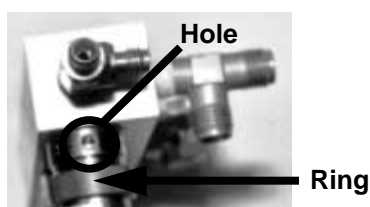
### 7-9.10 Solenoid Valve

1. Perform Steps 1-5, para. 7-9.9.



**Figure 7-31 Valve Connector/Manifold Fittings**

2. Remove valves, fittings, and electrical connectors from manifold.
3. Turn the knurled ring of the solenoid valve counterclockwise — 1/2-turn. DO NOT DISASSEMBLE.



**Figure 7-32 Solenoid Components**

4. Insert a small phillips screwdriver or a 1/8-inch metal dowl-pin into one of the holes located around the lower portion of the solenoid valve (preferably the one closest to the manifold) and unscrew the solenoid valve in a counterclockwise direction until it is free of the manifold.
5. Turn the knurled ring of the replacement solenoid valve counterclockwise — 1/2-turn. DO NOT DISASSEMBLE.



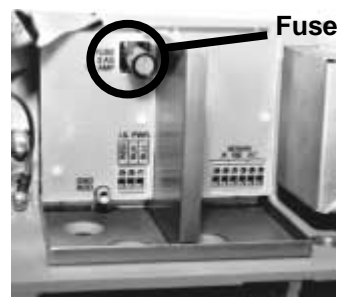
**Figure 7-33 Installing Solenoid Valve**

6. Mount the replacement solenoid valve in its manifold position and slowly turn the lower portion clockwise, properly engaging the threads into the manifold. Screw in the solenoid valve, until snug, then 1/4-turn more.

7. Reconnect the electrical connector, close the main board/manifold access door, and the TCU enclosure door (secure enclosure door screws).
8. Turn on main power.
9. Check operation of solenoid valve, using the diagnostics page (see 7-5.2).

### 7-9.11 Solenoid Valve Fuse

1. Disconnect main power to the explosionproof power supply.
2. Open the TCU enclosure, by unscrewing (2) captive screws located on the front door.
3. Pull up on the input box cover latch and remove the cover by lifting up and out (see 7-9.4).



**Figure 7-34 Solenoid Fuse Location**

4. Remove the fuse, using a standard tip screwdriver to turn the fuse holder 1/4-turn counterclockwise and pull it out.
5. Change out the fuse on the holder, insert into the fuse holder body and turn 1/4-turn clockwise.
6. Install the input box cover and close the TCU enclosure door.
7. Reconnect the main power.

### 7-9.12 Power Supply

1. Disconnect main power to the TCU explosionproof power supply unit.



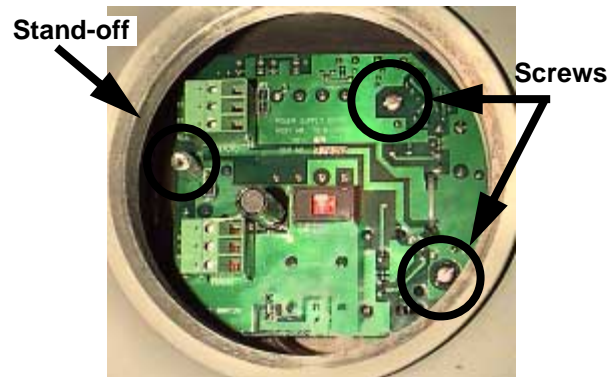
**Figure 7-35 Power Supply Connections**

2. Open the power supply enclosure, by rotating the enclosure cover.
3. Disconnect the I.S. ground cables, ground rod cable, and AC input leads.



**Figure 7-36 Power Supply Foam Cover**

- 4) Remove the protective foam cover.

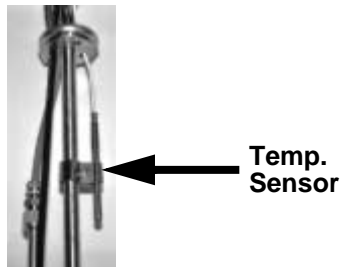


**Figure 7-37 Pwr. Board Stand-off and Mounting Screws**

5. Remove the power supply circuit board, by removing (2) slot-head screws and the ground cable standoff. Pull the board assembly out of the enclosure.
6. Disconnect plug-in connector that has a RED, BLACK, and BLUE wires.
7. Install the replacement board assembly in the reverse order.
8. Connect the I.S. ground cables, ground rod cable to the standoff, and AC input leads.
9. Install power supply enclosure cover.
10. Turn on TCU main power.

### 7-9.13 Temperature Sensors

#### 7-9.13.1 Probe Temperature Sensor



**Figure 7-38 Probe Temp. Sensor Location**

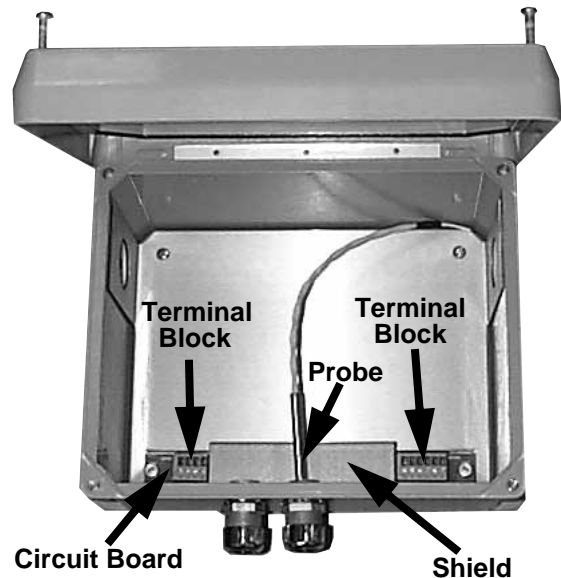
1. Slowly remove probe assembly from tank.
2. Remove faulty sensor, by loosening temperature sensor clip (screw/nut) assembly enough to allow sensor to slide out of clip.
3. Thread sensor assembly out through the tube sensor plates and guide rings.
4. Open the Tank Top Junction Box and disconnect the appropriate temperature sensor cable connection at the lower right terminal block.
5. Pull the probe cable out through the seal.
6. Pull the new cable through the vapor barrier and reconnect cable inside the Tank Top Junction Box.
7. Add sealant around new cable.
8. Thread sensor and cable back through guide rings and tube sensor plates.
9. Slide sensor into mounting clip and tighten screw/nut assembly.
10. Lower probe assembly into tank and mount, as described in Section 3 (3-3.3.3.2).

#### 7-9.13.2 Tank Top Junction Box Temp. Sensor



**Figure 7-39 Tank Top Box Enclosure**

1. Open Tank Top Junction Box cover by unscrewing the (2) screws at the bottom (see Figure 7-39).



**Figure 7-40 Tank Top Box Temp. Probe**

2. Disconnect the tank top temperature sensor connections at the lower right terminal block.
3. Loosen the watertight seal that the sensor feeds through, and remove the sensor.
4. Install replacement sensor in the reverse order and close/secure the Tank Top Junction Box cover.

#### 7-9.14 Tank Top Junction Box Circuit Board Replacement

1. Open the Tank Top Junction Box.
2. Disconnect the temperature sensor connections at the lower right terminal block.
3. Disconnect the temperature sensor signal line connections at the lower left terminal block.
4. Disconnect the lightning ground cable.
5. Remove (2) small phillips-head screws that secure the circuit board shield.
6. Remove the (2) standoffs (one at each end) that secure the circuit board in place. Use a 5/16" nut driver. Remove circuit board.
7. Install the replacement or repaired circuit board in the reverse order and close the Tank Top Junction Box.



## SECTION 8

### PARTS LIST/DRAWINGS

#### 8-1 GENERAL

TCU components are listed in Table 8-1 and identified by item number in Figure 8-1.

#### 8-2 ASSOCIATED EQUIPMENT PARTS

##### 8-2.1 Tank Top Junction Box

Tank Top Junction Box P/N: TS10-1319A

Circuit Brd. Assy. P/N: TS10-1079B

Temperature Probe P/N: TS10-1250B

##### 8-2.2 Network Barrier

Network Barrier P/N: TS10-1300A

Circuit Brd. Assy. P/N: TS10-1257B

##### 8-2.3 Power Supply

Power Supply P/N: TS10-1020A

Circuit Brd. Assy. P/N: TS10-1045B

##### 8-2.4 Regulator Assembly

Regulator Assembly (w/relief valve/filter)

P/N: TS10-1317A

Gauge (0-30 PSIG) P/N: DD64-1022T

Gauge (0-5000 PSIG) P/N: DD64-1021T

Pressure Switch (4500 SWP/200 PSIG)

P/N: DD68-1165T

HP Regulator (Brass, 25 PSIG, w/Filter)

P/N: 0127-1017T

**Table 8-1 Series 3500 TCU Parts List**

Item	Description	Part Number	Per Unit
1	Support Assembly, Main Board	TS10-1060B	1
2	Screw, Self-tap, 10-24 x 1/4-LG	0946-0002J	4
3	Pin, Hinge	1130-1112C	2
4	Support, DPE	TS10-1137C	2
5	Screw, Pan. Hd.	0119-0014J	2
6	Screw, 8-32 x 3/8, Self-tap	0938-0008J	3
7	Washer, Int. Tooth, #8	0003-0066K	8
8	Washer, Ext. Tooth, #8	0003-0050K	3
9	Washer, Int. Tooth, #6	0003-0070K	5
10	Nut, Hex, 6-32, SST	0500-0021J	5
*11	Keypad/Display Assembly (not shown)	TS10-1067B	1
12	Cable Assembly, Solenoid	TS10-1059C	1
13	Case, Machined and Painted	TS10-1077C	1
14	Washer, Neoprene	0003-1136K	2
15	Flg. Nut, 5/16-18	0500-1107J	2
16	Screw, Flat Hd., 5/16-18	0240-1012J	2

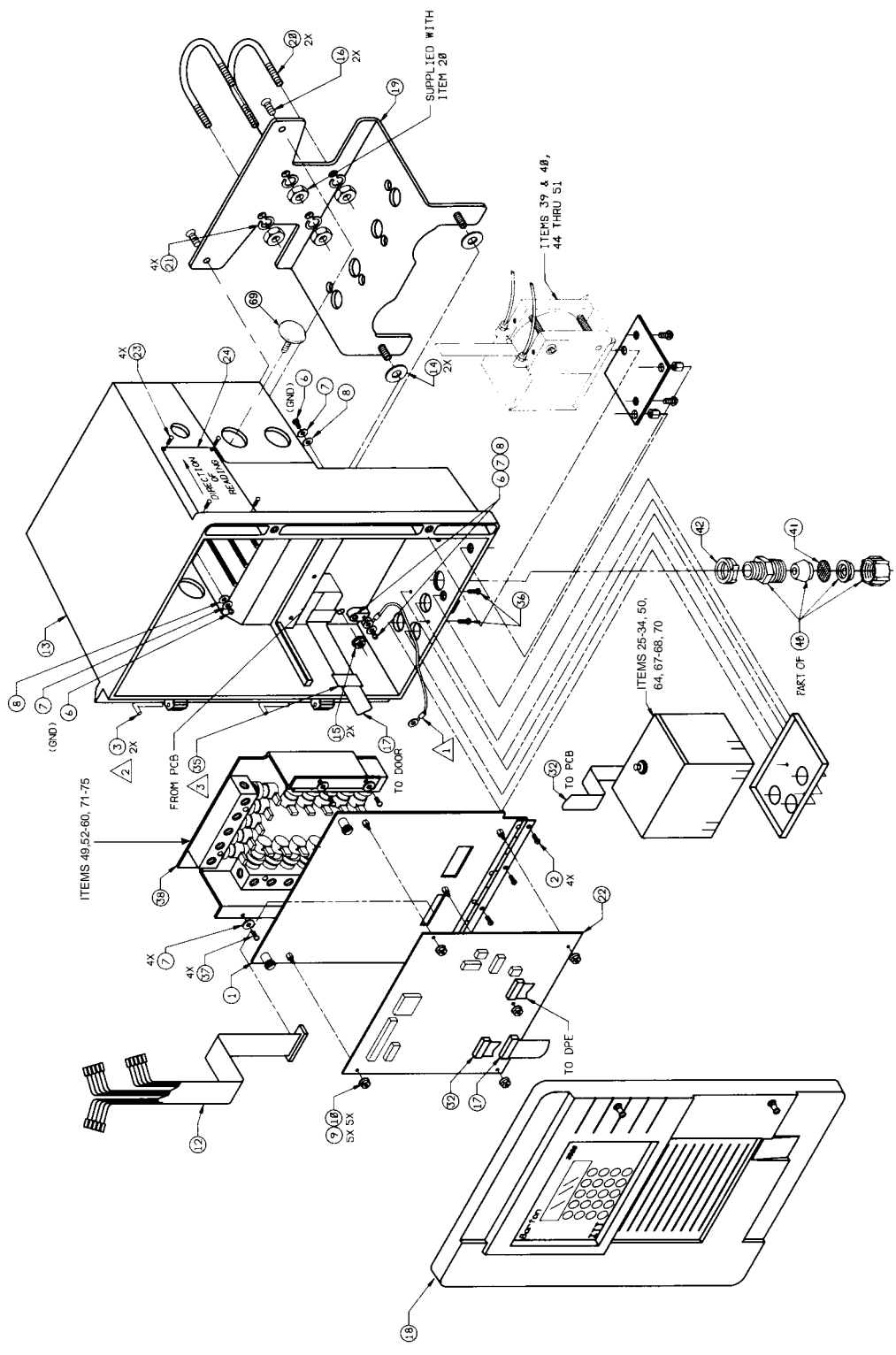
**Table 8-1 Series 3500 TCU Parts List (Continued)**

<b>Item</b>	<b>Description</b>	<b>Part Number</b>	<b>Per Unit</b>
*17	Cable Assembly, Keypad/Display	TS10-1071C	1
18	Door Assembly	TS10-1074B	1
19	Bkt., Universal, Stl.	1130-1102C	1
20	U-Bolt, Stl., w/Nuts	0440-0001J	2
21	Washer, Split-lock	0003-0006K	4
*22	PCB Assembly, Main Board	TS10-1057B	1
23	Screw, Taptite, 2-56 x 1/4 LG, SST	0938-0010J	4
24	Label, CSA, I.S.	TS10-1063G	1
25	Cover, Input Box	TS10-1037C	1
26	Base, Input Box	TS10-1038C	1
27	Shield, Power Supply	TS10-1041C	1
28	Shield, Network	TS10-1040C	1
29	Support, Input Box	TS10-1039C	1
30	Screw, Taptite, Pan Hd., 4-40 x 1/4 LG	0938-0012J	4
*31	Input Board Assembly	TS10-1036B	1
32	Cable Assembly, I.S./Network. Input	TS10-1076C	1
33	Latch, One-piece, Nylon	0180-1009T	1
34	Post, Circuit Board, 3/4", Nylon	0018-1071T	6
35	Clip, self-adhesive	0142-1031T	A/R
36	Screw, 6-32 x 1/2, SST	0119-0022J	2
37	Screw, 8-32 x 15/16, SST	0119-0010J	4
38	Manifold Assembly	TS10-1019B	1
*39	DPE Assembly, 0-300" w.c.	TS10-1344A	1
40	Spacer	TS10-1118C	3
41	Filter Disk	TS10-1129C	1
42	Locknut, Sealing	0505-1066M	1
43	Standoff, 5/16 x1, Hex, M/F	0152-1153T	1
44	Cover, DPE	TS10-1154C	1
45	Screw, Pan Hd., 10-32 x 1/2 LG	0119-1018J	3
46	Washer, Lock, #10	0003-0032K	3

**Table 8-1 Series 3500 TCU Parts List (Continued)**

<b>Item</b>	<b>Description</b>	<b>Part Number</b>	<b>Per Unit</b>
47	Washer, Flat, #10	0003-0047K	4
48	Connector, Liquid Tight	0505-1065M	1
49	Tubing, 1/8" dia., Polyethelene, Natural	0800-0005P	A/R
50	Washer, Internal Tooth, #10	0003-0071K	1
51	Fitting, Elbow, 1/16 NPT	0102-1015M	2
52	Tee, Male, 1/4" Tube, 1/8" NPT	0201-1002M	A/R
53	Tee, Male, 1/8" Tube, 1/8" NPT	0201-1001M	A/R
54	Elbow, Male, 1/8" Tube, 1/8" NPT	0101-1001M	A/R
55	Connector, Male, 1/4" Tube, 1/8" NPT	0501-1001M	A/R
*56	Orifice Assembly	TS10-1345T	A/R
57	Fastener, Self-seal, 10-32 x 1/8	0002-1024J	A/R
58	Plug, 1/8" NPT, Hex Skt.	0604-0007L	A/R
*59	Solenoid Valve, 9V, Tested	TS10-1140B	A/R
60	Tubing, 1/4" dia., Polyethelene, Natural	0800-0011P	A/R
61	Deleted		
62	Adhesive, Loctite-430 (Not Shown)	0007-1067U	A/R
63	Adhesive, Loctite-290 (Not Shown)	0007-1042U	A/R
64	Nut, Hex, 10-32, SST	0500-0032J	1
65	Cotter Key (Not Shown - part of door hinge pin)	0003-1046T	2
66	Cable Tie, 4", Self-locking (Not Shown)	0188-1001T	20
67	Washer, External Tooth, #10 (Not Shown)	0003-1109K	1
68	Terminal Lug, #10 (Not Shown)	0038-1358T	1
69	Hole Seal, 1-1/2"	0192-1031T	A/R
70	Washer, Internal Tooth, 1/4"	0003-1110K	1
71	Thread Compound, Loctite PST-567	0006-1011U	A/R
72	Insert, 1/8" Tube, FTG (Not Shown)	TS10-1104C	A/R
73	Insert, 1/4" Tube, FTG (Not Shown)	0116-1021T	A/R
74	Tubing, Elbow, 1/4" (Not Shown)	TS10-1206C	1
75	In-line Filter, 1/4" Tube, Brass (Not Shown)	0138-1038T	1
Notes: * Indicates recommended spare part. A/R = as required			





# TCU SETUP CHECKLIST

## (Series 3500 ATG TCU Manual #97K15)

Use this checklist as a configuration reference - circle selection or enter value:

- ☐ **MEMORY BACKUP BATTERY is ON** (DIP SWITCH #4) (para. 7-7.2, page 7-15)
- ☐ **SUPERBOOT Procedure Performed** (para. 7-7.4, page 7-16):
- ☐ TCU Unit Number: \_\_\_\_\_

### MASTER PASSWORD (page 5-7)

Keep on a separate sheet/store in a secure location. See Section 5 for details — required to add, change, or delete users/passwords.

### USERS/PASSWORDS (page 5-11)

#### Default Level 2 User:

**Name = 2; Password = A2**

A level 2 user must be logged in to setup TCU.

#### ☐ LOGIN (page 5-14)

### UNIT/TANK LABELS (Unit-page 5-16, Tank-page 5-35) (per TCU)

- ☐ Unit Label: \_\_\_\_\_
- ☐ Tank Labels-1: \_\_\_\_\_, 2: \_\_\_\_\_, 3: \_\_\_\_\_, 4: \_\_\_\_\_]

### UNIT SETUP (page 5-27)

#### ■ Tank Type:

- ☐ 2 Tall + Water
- ☐ 3 Short + Water
- ☐ 4 short - Water
- ☐ Display Unit

#### ■ Set Clock

#### ■ Measurement Times:

- ☐ Leak Interval: \_\_\_\_\_ (HH:MM)
- ☐ Density Interval: \_\_\_\_\_ (HH:MM)
- ☐ Water Interval: \_\_\_\_\_ (HH:MM)
- ☐ Zero Interval: \_\_\_\_\_ (HH:MM)

#### ☐ Measurement Units:

- Level: ☐ 8ths ☐ 10ths ☐ 16ths ☐ Meters
- Volume: ☐ USG ☐ ImpG ☐ M<sup>3</sup> ☐ BBL
- Temperature: ☐ DegF ☐ DegC
- Density: ☐ SpGr ☐ API
- Mass: ☐ Lb ☐ Kg ☐ Ton ☐ LTon

#### ☐ Unit Values:

- ☐ Max Purge: \_\_\_\_\_ [Sec]
- ☐ Purge Tol: \_\_\_\_\_ [Inch]
- ☐ Purge Time: \_\_\_\_\_ [Sec]
- ☐ Stab Time: \_\_\_\_\_ [Sec]
- ☐ Bal Tol: \_\_\_\_\_ [Inch]
- ☐ Bal Tries: \_\_\_\_\_
- ☐ Retries: \_\_\_\_\_
- ☐ Zero Tol: \_\_\_\_\_ [Inch]
- ☐ Zero Time: \_\_\_\_\_ [Sec]
- ☐ Num DP Samps: \_\_\_\_\_
- ☐ Num T Samps: \_\_\_\_\_
- ☐ Bypass Time: \_\_\_\_\_ [Sec]
- ☐ Bypass Tries: \_\_\_\_\_
- ☐ Reg Press: \_\_\_\_\_ [PSI]
- ☐ Ref. Volt: \_\_\_\_\_ [Volt]
- ☐ Hydro Purge: \_\_\_\_\_ [Sec]
- ☐ TrnDen Purge: \_\_\_\_\_ [Sec]
- ☐ Fst Stab Time: \_\_\_\_\_ [Sec]
- ☐ Atm Pres: \_\_\_\_\_ [PSI]

#### ■ Version No.: (Not Entered- Ref. Only)

### TANK SETUP (page 5-37) (per Tank)

#### ■ Tank Values: (units = Meas. units per Unit Setup)

#### ■ Level Alarm Setpoints:

- ☐ HiHi \_\_\_\_\_ [units]
- ☐ Hi \_\_\_\_\_ [units]
- ☐ Lo \_\_\_\_\_ [units]
- ☐ LoLo \_\_\_\_\_ [units]

#### ■ Vol Alarm Setpoints:

- ☐ HiHi \_\_\_\_\_ [units]
- ☐ Hi \_\_\_\_\_ [units]
- ☐ Lo \_\_\_\_\_ [units]
- ☐ LoLo \_\_\_\_\_ [units]

#### ■ Temp. Alarm Setpoints/Defaults:

- ☐ HiHi \_\_\_\_\_ [units]
- ☐ Hi \_\_\_\_\_ [units]

(Continued on back page)

■ Temp. Alarm Setpoints/Defaults (continued):

- ☐ Lo \_\_\_\_\_ [units]  
☐ LoLo \_\_\_\_\_ [units]  
☐ Def: ☐ Auto ☐ Last ☐ On ☐ Disabled  
☐ DefH \_\_\_\_\_ [units]  
☐ DefL \_\_\_\_\_ [units]  
☐ DefV \_\_\_\_\_ [units]

■ Density Alarm Setpoints/Defaults:

- ☐ HiHi \_\_\_\_\_ [units]  
☐ Hi \_\_\_\_\_ [units]  
☐ Lo \_\_\_\_\_ [units]  
☐ LoLo \_\_\_\_\_ [units]  
☐ Def: ☐ Auto ☐ Last ☐ On ☐ Disabled  
☐ DefH \_\_\_\_\_ [units]  
☐ DefL \_\_\_\_\_ [units]  
☐ DefV \_\_\_\_\_ [units]

■ Mass Alarm Setpoints:

- ☐ HiHi \_\_\_\_\_ [units]  
☐ Hi \_\_\_\_\_ [units]  
☐ Lo \_\_\_\_\_ [units]  
☐ LoLo \_\_\_\_\_ [units]

■ Water Alarm Setpoints:

- ☐ HiHi \_\_\_\_\_ [units]  
☐ H \_\_\_\_\_ [units]  
☐ Def: ☐ Auto ☐ Last ☐ On ☐ Disabled  
☐ DefH \_\_\_\_\_ [units]  
☐ DefV \_\_\_\_\_ [units]

■ Tank Setup Page Values (page 5-52)

■ Probe Measurements:

- ☐ RtoBot: \_\_\_\_\_ [units]  
☐ NtoBot: \_\_\_\_\_ [units]  
☐ WtoBot: \_\_\_\_\_ [units]  
☐ HtoBot \_\_\_\_\_ [units]  
☐ Offset \_\_\_\_\_ [Inch]  
☐ LFactR: \_\_\_\_\_ ☐ Default 1.0000  
☐ DFactR: \_\_\_\_\_ ☐ Default 1.0000

- ☐ LFactN: \_\_\_\_\_ ☐ Default 1.0000  
☐ DFactN: \_\_\_\_\_ ☐ Default 1.0000  
☐ LFactW: \_\_\_\_\_ ☐ Default 1.0000  
☐ DFactW: \_\_\_\_\_ ☐ Default 1.0000

■ H Probe Enbl: ☐ YES ☐ NO

■ HtoR Den Enbl: ☐ YES ☐ NO

☐ WaterSG: \_\_\_\_\_ (Local Water SpGr)

■ ASTM 1250: ☐ YES ☐ NO

If ASTM = NO:

☐ Fluid Expansion Factor (F Exp)  
Base= \_\_\_\_\_ Exponent= \_\_\_\_\_

☐ Tank Expansion Factor (T Exp):  
Base= \_\_\_\_\_ Exponent= \_\_\_\_\_

■ (units = Meas. units per Unit Setup)

☐ SFill: \_\_\_\_\_ [units]

☐ N2 Comp: ☐ YES ☐ NO

☐ TtoBot: \_\_\_\_\_ [Inch]

☐ UtoBot: \_\_\_\_\_ [Inch]

☐ Probe T Comp: ☐ YES ☐ NO

☐ Base T: \_\_\_\_\_ [units]

☐ Pan D Comp: ☐ YES ☐ NO

☐ Start: \_\_\_\_\_ [Inch]

☐ Adj Vol: \_\_\_\_\_ [units]

☐ Ref Den: \_\_\_\_\_ [units]

☐ TrnDenHt: \_\_\_\_\_ [Inch]

☐ TrnStrtTries: \_\_\_\_\_

☐ TrnCVol: \_\_\_\_\_ [units]

☐ TrnStrtSamps: \_\_\_\_\_

☐ TrnStopTries: \_\_\_\_\_

☐ Trn Rate: \_\_\_\_\_ [units]

☐ TrnStopSamps: \_\_\_\_\_

■ Strapping Table Data:

Enter directly from Tank Manufacturer's supplied Strapping Table or supplied data disk (using PC).

■ Product Label:

Product Label can only be entered using the Series 3500 PC Software.

## **STANDARD BARTON WARRANTY**

### **A. Warranty**

ITT Barton warrants that at the time of shipment the products manufactured by ITT Barton and sold hereunder will be free from defects in material and workmanship, and will conform to the specifications furnished by or approved by ITT Barton.

### **B. Warranty Adjustment**

- (1) If any defect within this warranty appears, Buyer shall notify ITT Barton immediately.
- (2) ITT Barton agrees to repair or furnish a replacement for, but not install, any product which within one (1) year from the date of shipment by ITT Barton shall, upon test and examination by ITT Barton, prove defective within the above warranty.
- (3) No product will be accepted for return or replacement without the written authorization of ITT Barton. Upon such authorization, and in accordance with instructions by ITT Barton, the product will be returned shipping charges prepaid by Buyer. Replacements made under this warranty will be shipped prepaid.

### **C. Exclusions from Warranty:**

- (1) THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER EXPRESSED OR IMPLIED WARRANTIES OR MERCHANTABILITY, OR FITNESS, OR OTHERWISE.
- (2) Components manufactured by any supplier other than ITT Barton shall bear only the warranty made by the manufacturer.
- (3) "In no event shall ITT Barton be liable for indirect, incidental or consequential damages nor shall the liability of ITT Barton arising in connection with any products sold hereunder (Whether such liability arises from a claim based on contract, warranty, tort or otherwise) exceed the actual amount paid by Buyer to ITT Barton for the products delivered hereunder."
- (4) The warranty does not extend to any product manufactured by ITT Barton which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by ITT Barton.
- (5) The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than at ITT Barton's factory or service locations by persons not expressly approved by ITT Barton.

For additional information, contact ITT Barton.